1958

# Eugenics Quarterly

Vol. 5 December, 1958 No. 4

**THE STATUS OF HUMAN GENETICS IN WESTERN EUROPE**
*Kurt Hirschhorn, M.D.*

**INTERVALS BETWEEN CONFINEMENTS IN ABSENCE OF BIRTH CONTROL**
*Louis Henry*

**CURRENT THEORIES ON THE ETIOLOGY OF MONGOLISM**
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# Hemophilia B

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**By**

**J. K. Moor-Jankowski, H. J. Huser, S. Rosin, G. Truog, Maria Schneeberger, M. Geiger**

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This monograph represents a separate edition of three papers published in "Acta Genetica et Statistica Medica" in 1957 and 1958. It is published in German, but with an English Foreword, extensive English Summaries of its three parts and with English footnotes to all the 53 tables and figures containing the complete genetical, clinical and hematological data of the study. In this way, the findings and the complete material are made accessible to the non-German speaking reader.

The subject of the Study is the investigation of the clinical, genetical and coagulation aspects of the Hemophilia B (PTC-Deficiency, "Christmas"-Disease) studied in the widespread and oldest described kindred of hemophiliacs, from the village of Tenna, Switzerland.

The authors present data on practically all descendants of the ancestral parent couple of this kindred, comprising 3,072 persons, among whom 55 were hemophiliacs in 13 generations between 1600 and 1955. About 1,500 descendants of the kindred were examined in the course of the five years of the investigation, among them 11 from the 13 hemophiliacs alive during this period. All genetical and clinical information, the coagulation findings together with case histories and personal data, and the complete list of the sources of information collected form the first part of the Study. The second part of it gives statistical computation and genetical evaluation of the complete material for the fertility and mortality in the kindred of Tenna and for the fitness of bleeders and of the female carriers.

The third part of the Study is devoted mostly to the clinical manifestations of the disease and to the detailed coagulation studies of Tenna Hemophiliacs. The possibility of linkage of Hemophilia B in Tenna kindred with color blindness and with the ability to smell hydrocyanic acid is further evaluated. Finally, on the basis of the data on the Hemophiliacs from Tenna, an attempt is made to provide a general outlook on the genetical problems involved in the recent findings in coagulation physiology.

A mimeographed bilingual Register of Names, containing particulars of all 3,074 persons covered by the study, has been deposited in several European and American Genetic Institutes and may be consulted under observance of medical discretion.

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# POPULATION REVIEW

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Vol. 5, No. 4, December, 1958 *Eugenics Quarterly*

# THE STATUS OF HUMAN GENETICS IN WESTERN EUROPE*

KURT HIRSCHHORN, M.D.
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Post-graduate Medical School

MOST EUROPEAN MEDICAL SCHOOLS have some form of more or less organized teaching program in human genetics. These programs may be organized by groups ranging from a large, well-staffed institute to a single individual belonging to a clinical or basic science department. In almost all cases these groups are engaged in active research in genetics, and many of the individuals involved do some heredity counseling. An attempt is made here to summarize the most important activities of these groups in the fields of research, education and counseling.

## Sweden

Because of the accurate records available in Swedish churches and due to the presence of many isolated communities, Sweden has been very active in the field of human genetics. In some cases it is possible to trace families back to the sixteenth century with accurate information as to lifespan, fertility and consanguinity. For this reason much of the research has been in the field of population genetics.

In Uppsala, Professor Jan A. Böök is the director of the State Institute for Human Genetics. His predecessor, the late Professor Gunnar Dahlberg, is well known for his basic mathematical treatment of twin studies and other aspects of population genetics. Professor Böök has produced important work in the study of isolated populations, consanguinity, and the genetics of mental disease, especially schizophrenia. Dr. Marco Fraccaro, the assistant director, is also engaged in some excellent population studies, as well as heading the new program of cellular genetics by tissue culture methods. One aspect of this program is the study of chromosomal aberrations in radiated human cells. Other studies in progress are a survey of offspring of radiated parents, an evaluation of maternal age on congenital malformations, a systematic mapping of blood types in Sweden by Dr. L. Beckman and a study of the inheritance and detection of heterozygotes of juvenile amaurotic idiocy. In addition, the Institute is developing a full program of biochemical genetics under Dr. P. O. Nyman, including, among others, a study of the inheritance of serum proteins. Professor Böök is in

*This article is based on a study of human genetics made in Europe during the year 1957-1958. A travel and study grant from the Population Council, Inc., and the John Bergquist Fellowship of the American-Scandinavian Foundation made this study possible. The majority of the author's time was spent at the State Institute for Human Genetics in Uppsala, Sweden, but most of the centers and individuals interested in human genetics were visited.

charge of a course in medical genetics at the medical school, and both he and Dr. Fraccaro are consulted in cases requiring heredity counseling. The Institute is occasionally called upon to render a decision in a paternity dispute. This institute is one of the best equipped and most modern of the European centers and carries great potential as a future leader in human genetics research.

In Stockholm, activity in human genetics is concentrated in the Psychiatric Institute of the University, where Professor Sjögren and Dr. Alström have described a number of new inherited syndromes associated with mental deficiency. They have also been active in assessing the incidence and etiologies of mental defects in North Sweden. Dr. Alström has been interested in the question of the inheritance of epilepsy. This institute does the bulk of heredity counseling in questions of mental deficiency in Sweden.

In Lund, at the Institute of Genetics, Dr. C. A. Larsson is the human geneticist, responsible for teaching the course in the medical school and for heredity counseling in this area. He is at present engaged in a far-reaching population study of South Sweden with the special purposes of studying rates of consanguineous matings and their effects, as well as estimating the incidence and etiologies of mental deficiency. At the same institute Dr. Reitalu is studying the nature of the sex chromatin in the nuclei of human and other mammalian cells.

**Norway**

In Oslo, Dr. Jan Mohr is in the process of building up an essentially new unit of human genetics. He is charged with teaching the course at the medical school, and he is doing a moderate amount of counseling. His special interests, as reflected by the activities of his department, lie in the direction of serological and blood protein inheritance. He is attempting to set up a central heredity register for all of Norway, drawing information from schools for the mentally deficient, the blind and the deaf, from selected hospital departments and from the Central Bureau of Statistics, the latter supplying him with the names of all twin births in Norway. The purpose of this register is mainly as a source for study material, but it is also helpful for counseling. Dr. Mohr is also undertaking a study attempting to estimate increase of rates of mutation due to age and to radiation. He is occasionally called upon to aid in questions of disputed paternity.

**Denmark**

One of the oldest centers for the study of human heredity is the University Institute for Human Genetics in Copenhagen, directed by Professor Tage Kemp. The Institute has the oldest existing heredity register, with information about the majority of cases of mental disease, blindness, deafness, epilepsy and twin births in Denmark. The principal uses made of this register are for twin studies and in counseling. The Institute handles about 1500 cases of counseling a year, 90 per cent of which are cases of application for legalized abortion or sterilization. In such cases the register is used as one of the criteria for the presence of deleterious genes. Dr. M. Hauge and Dr. Harvald are attempting to assess the hereditary influence on various diseases by means of twin comparisons. Dr. Hauge is also engaged in studies on the inheritance of uric acid levels, the effect of parental radiation upon the offspring, and the effect of certain serum protein fractions. Dr. Schultz-Larsen is working on the elucidation of the microstructure and ultrastructure of human sperm. Dr. U. Nielsen is evaluating mental disease in twins. Professor Kemp is in charge of the course given at the medical school, which includes a course in biostatistics.

**Germany**

Despite the absence of an organized department of human genetics in Hamburg,

Dr. W. Lenz of the Department of Pediatrics is doing a great deal of work on the topics of congenital malformations, mongolism and other related fields. He is also called upon to do heredity counseling, as well as consultations for the other clinical departments.

Professor O. v. Verschuer is the director of the University Institute for Human Genetics in Muenster. The principal activity at this time is the establishment of a heredity register for the Muenster area by Dr. Ebbing. The purposes of this register are the estimation of incidence rates and mutation rates for certain diseases, and as a source for case material in future studies. The population and clinical work is led by Dr. Koch and includes a recent study of amyotrophic lateral sclerosis by Dr. Haberland. Dr. Degenhardt is working on the production of congenital malformations by anoxia in experimental animals. Professor v. Verschuer is in charge of the course at the medical schools and is himself interested in twin research.

A visit was not made to the Max Planck Institute for Hereditary Biology in Berlin, where Professor Nachtsheim and Dr. Vogel have been working on problems of human genetics, nor to the Department of Human Genetics at the University of Goettingen. The new director of this department is Professor Becker, who has worked in the past on neuromuscular disorders.

**Holland**

At the Institute for Preventive Medicine in Leyden, Dr. J. van den Bosch has a department of human genetics. He is engaged in studying the incidence and mode of inheritance of a number of traits, including hemophilia, muscular dystrophy, optic atrophy and microcephaly. He has developed a method for finding the asymptomatic heterozygotes in Marie-Tooth disease by electromyographic tests. He has a fairly heavy schedule of counseling and consultation, as well as being in charge of the course in medical genetics at the University. Dr. Waardenburg has recently retired from active teaching and is in the process of writing a book on medical genetics.

The Institute for Human Genetics at Groningen, where Professor Polman is the director, was not visited.

**Italy**

In Rome, the Institute for Medical Genetics and Twin Research, Professor L. Gedda, director, has some of the most modern and beautiful equipment seen on this trip. The facilities for in-patients are excellent. The principal activity at this time is in the preparation and editing of a six-volume "Treatise on Medical Genetics," to be published in the near future. In general, the main interest of the institute is in the field of twin research.

At the Institute of Genetics in Pavia, under the direction of Professor Buzzatti-Traverso, the principal activity is in the field of microbial, drosophila and yeast genetics. However, Dr. L. Cavalli-Sforza is engaged in work on human population genetics. He has studied the structure of some North Italian isolates, is interested in the relation of certain anthropometric and blood-group characters to disease, and is planning to study the distribution of blood groups in Italy. Recently, Dr. DeCarli has begun work on human tissue in an attempt to find genetic markers in somatic cells. By this method many problems in human genetics could be solved by methods now used in unicellular organisms.

In Milan, Professor L. Gianferrari of the Department of Biology also heads a unit of human genetics. Most of the work there has been concerned with the inheritance of cancer. Dr. Morganti has been mapping out the blood-group distribution of North Italy, while Dr. A. Serra has recently completed an exhaustive survey of consanguineous marriages in North Italy. Professor Gianferrari also teaches the course in human genetics at the medical school.

Dr. R. Ceppellini of the Department of

Genetics in Turin has been able to define the inheritance of the Lewis blood groups and has recently demonstrated the allelity of the genes for thalassemia and sickle cell hemoglobin. He has long been active in the study of the reasons for and effects of thalassemia and is now studying the effects of polymorphism in small populations. He also teaches the courses of general and human genetics at the University of Turin.

The Institute of Genetics in Naples, gaged in studying the incidence and mode was not visited. However, the human geneticist from that institute, Dr. M. Siniscalco, who has done much to clarify the population genetics of thalassemia, discussed his work at length with the author. He now plans to concentrate on a study of the inheritance of human serum proteins, as well as the development of human tissue culture for genetic studies.

**Switzerland**

The Department of Human Genetics in Geneva is associated with the ophthalmology clinic, whose director, Professor Franceschetti, has long worked in defining the inherited diseases of the eye. Dr. D. Klein has recently completed a study of the muscular dystrophies and is doing work on the population genetics of several Swiss and French isolates. Both Professor Franceschetti and Dr. Klein are teaching the course in medical genetics at the university and are doing a good deal of heredity counseling.

**France**

In Paris there is activity in human genetics at three places: the Department of Medical Genetics, the Department of Pediatrics, and the National Demographic Institute. The course in the medical school is taught primarily by the Department of Medical Genetics, while counseling is shared by this department with the Department of Pediatrics.

The Department of Medical Genetics is directed by Professor Lamy. Dr. J. Frézal has completed population studies on the incidence and inheritance of retinoblastoma and anencephaly. He is at present interested in surveys and evaluations of aminoacidurias in children with mental deficiency and other illnesses. Dr. J. deGrouchy has made a study of the genetic effect on congenital heart disease and is now examining normal and abnormal hemoglobins by electrophoretic methods.

At the Department of Pediatrics, Professor Turpin, director, De. Lejeune has just completed a large-scale study of the effect of parental radiation on the sex-ratio of the offspring in an attempt to evaluate the appearance of lethal sex-linked mutations. He is doing a long-term study of children, who were irradiated *in utero*, to observe whether any unfavorable mutations had occurred. He is utilizing aminoacid chromatography of urine and serum in the differential diagnosis of mental deficiency and other illnesses. He has recently begun to use tissue culture of human cells in an attempt to find chromosomal aberrations in cells from patients with known inherited diseases.

At the National Demographic Institute Dr. J. Sutter is concentrating on population studies of selected areas of France for the study of rates of consanguineous matings and their effects, differences in sex-ratio, and the question of linkage of hair color with inherited defects in dentition.

**Great Britain**

One of the leading and also most active institutions for the study of human genetics in Europe is the Galton Laboratory of University College in London. The director, Professor L. S. Penrose, has contributed some of the basic formulations for the mathematical study of human inheritance. He has made studies of mental deficiency, anencephaly, and a variety of other subjects in the field of human genetics. At present he is engaged in attempting to reproduce mechanically the various functions attributed to chromosomal material for the purpose of self-duplication. The staff of the

Laboratory consists of specialists in biostatistics, population genetics, serology, cytology, developmental genetics, and so forth, thereby representing a well-rounded team for the study of all aspects of human genetics.

Associated with the Galton Laboratory, but working in the Biochemistry Department of the London Hospital Medical School, Dr. H. Harris has done some of the pioneer work in the analysis of the inheritance of haptoglobins and beta-globins by combining biochemical techniques with genetic studies. He has also been instrumental in the elucidation of some of the mechanisms of the aminoacidurias and of hypophosphatasia. His forthcoming book on Human Biochemical Genetics will fill a great need in bringing together the many recent advances in this rapidly growing field.

Also collaborating with Dr. Harris are Professor Dent and his coworkers at the Department of Medicine of University College Hospital. They have been instrumental in defining some of the clinical entities produced by inborn metabolic errors.

Also in London, at the Hospital for Sick Children, Dr. Fraser-Roberts heads a unit for medical genetics. He is primarily engaged in a study of the relationship of blood groups to diseases. He has recently completed a large-scale study on the genetic influence on essential hypertension. He also contributes a fair amount of his time to heredity counseling.

Visits were not made to Professor Stevenson's department at Oxford and Professor Pontecorvo's department at Glasgow. The former is primarily concerned with population studies and their public health aspects, although Dr. Allison is active in the field of human biochemical genetics. In Glasgow the emphasis at this time is on human tissue culture, with a view of defining some questions of human inheritance on a cellular level.

**Summary and Conclusions**

An attempt has been made here to review the salient features of the activity in human genetics in Western Europe at this time. The striking impression is the universal interest of the medical schools in encouraging teaching and research in this field. It becomes quickly apparent that there is a vast difference in the attitude and activity of U. S. medical schools in this subject as opposed to the European ones. The importance of organized departments of human genetics as unifying factors of many fields of basic and clinical research is gradually becoming more obvious. As our understanding of the basic mechanisms of enzymatic and metabolic behavior grows, and as we learn to appreciate the importance of certain inherited characteristics on population structure, we shall turn more and more to the human geneticist for guidance and as a unifying force in medical research. The need for teaching genetics to the medical student is great. The time has come to learn a lesson from our European colleagues and to encourage the establishment of departments of human genetics in all of our medical schools.

# INTERVALS BETWEEN CONFINEMENTS IN THE ABSENCE OF BIRTH CONTROL

LOUIS HENRY
Institut National d'Études Demographiques

VARIOUS STUDIES of historic populations have been carried out on the basis of family histories, some of which are readily available in the form of genealogies, while others are reconstructed in the course of such research. Using this approach, access is gained to a variety of data; in particular, the intervals between births, a subject much neglected in modern statistical study, are then directly available. Such data, on the other hand, concern populations in which birth control was much less frequently practiced than nowadays. Mostly confined to some segments of the leading classes, the practice was probably unknown to the bulk of the population until the end of the eighteenth century. Studies of the fertility of historic populations, therefore, are likely to produce information about the nature of human reproductivity when biological factors play the dominant part; in fact, this procedure promises to open some clues as to the manner in which these latter factors operate.

In the analysis of fertility here, each family whose history is known appears as a complex entity, with its number of births, and its time sequence of marriage, births, and termination of the marital union. Birth frequencies and family size are simple and current phenomena which have been studied much more frequently than the complex phenomena of this time sequence. The time sequence of births is the topic of this article which, without attempting to deal with the subject comprehensively, presents rather an example of what one may hope to learn from the time analysis of births occurring in particular families.

**Nature of the Problem**

In the absence of birth control children in families of sufficient marriage duration are usually numerous. For each family several distinct intervals between successive births can be noted. Using these data as raw material, an examination can be made of how the several birth intervals vary within the families and from one family to another.

The successive intervals are distinguished by the order of each preceding birth. Variations of birth intervals within the families, however, can scarcely be studied without note being taken of the effect of the birth order, whether regarded as a direct effect, or as an indirect effect of age of the mother or marriage duration, of which birth order is a correlated variable. Inter-family comparisons, furthermore, must be made for birth intervals of the same order, or else the variations due to family differences and those due to birth order differences become confused.

When a large number of observations are available, the best procedure is to analyze variations in birth intervals for completed families only, and separately for families of each given size.

Though preferable, this procedure cannot be used when the number of observations is small. It is then not possible to consider completed families only, nor to study families of each size separately. Even then, it remains necessary to preserve comparability, at least so far as orders of birth

are concerned. As a result, analysis of an aggregate of families having had *at least n* children permits, *at the most,* comparisons for the first $n - 1$ birth intervals. In practice the comparison must be confined to the first $n - 2$ intervals, because of the empirical finding that, in completed families, the last interval tends to be distinctly longer than all others irrespective of the preceding number of children or, in this case, irrespective of the order $n$ of the last birth interval.

Since only the $n - 2$ first birth intervals can be compared, $n$ must at least be 3; in fact, it must be more than 3, or else each family in the study is represented by a single birth interval only.

Another complication arises from various observations showing that the interval between two successive confinements tends to be shortened when the child born in the first of these confinements (or all children in the event of a multiple birth) dies very soon, e.g., within its first year of life. Part of the variation between birth intervals, therefore, is attributable to infant mortality. To eliminate this factor, here considered as vitiating, the comparison is confined to intervals where the preceding child (or at least one child in the event of multiple births) has attained at least one year of age. In this case the corresponding interval is called *normal.*

**The Data**

From a tally of the parish registers of Crulai (a village in Normandy) for couples married in the years from 1674 to 1742, the family histories have been reconstructed, i.e., at least insofar as these took place within the village of Crulai.[1]

The families were followed up from marriage to the end of the marital union by death of one spouse, or up to the last birth prior to the family's emigration from the village. The record is incomplete inasmuch as births may have occurred during a family's temporary absence from Crulai, baptisms may have remained unregistered, or a family history could not be reconstructed for other reasons (e.g., the family being inaccurately identified). Actually, some children for which there was no baptismal record were discovered because there was an eventual record of their death, their marriage, or some other incident revealing their existence. Hence, only such children of unrecorded birth were overlooked whose existence has not otherwise come to light. The number of these latter can be estimated as of a similar magnitude as that of children of unrecorded baptism whose existence was called to attention through some other record. Since these amount to a very small fraction of the total, these data can be regarded as sufficiently accurate.

For this study families were selected in this way. It was found that families with at least 6 confinements were both sufficiently numerous and had enough birth intervals suitable for analysis. Hence, attention was confined to these families. Among these were the following:

1. 32 families whose first 5 birth intervals were normal; excluding the last birth interval from study, these are families with at least 7 confinements.

2. 50 families whose first 4 intervals were normal.

3. 56 families whose first 3 intervals were normal.

As the second group of families is almost as numerous as the third, its study presents relatively greatest interest. These families, therefore, have been selected.

For each family, the average of the four intervals can be calculated, as well as its internal variance, which equals one-third of the sum of squares of deviations from

[1]See also Etienne Gautier and Louis Henry, *La population de Crulai, paroisse normande, étude historique.* (The Population of the Norman Parish of Crulai, a Historic Study) Travaux et documents of the Institute National d'Études Demographiques (Paris), Cahier no. 33.

the mean. Table I shows, for each of the 50 families, the successive 4 normal intervals between births (of order 1-2, 2-3, 3-4, and 4-5), the mean interval, and the estimate of its internal variance. The families have been ranked by ascending order of these variances.

It will be noted that the last 4 families are clearly discontinuous from the 46 preceding ones, in the array of variances: the variance of the 46th family is less than 150, that of the 47th exceeds 275, and that of the 50th amounts to 400.

As stated in the foregoing, a few children have probably escaped from all records; more often than not, this would have occurred in the case of one child only escaping per family, since the chance of discovering—through some other record—*at least* one child whose date of birth or baptism is not known increases with the number of children escaping in a family. When only one child is omitted, one of the apparent birth intervals is, in reality, the sum of two intervals, other birth intervals being ascertained correctly. A sharp increase of the calculated internal variance is the most likely result in such a case.

That this is so can be demonstrated in a calculation of birth intervals for the group of those families whose first 5 intervals were normal: omitting arbitrarily one of their births, e.g., their fourth, the resulting apparent 4 birth intervals (where an interval 3-4 is substituted for the sum of the actual intervals 3-4 and 4-5) have an array of variances of which two-thirds exceed 150, while more than half are in the range from 150 to 450.

These considerations justify elimination of the last 4 families from the present analysis. The study, therefore, is confined to 46 families whose first 4 intervals between confinements were normal.

### Analysis of Variance: Differences by Birth Order

For this limited aggregate, the distribution of birth intervals of successive order is as follows:

| Length of interval (completed | Normal birth interval of order: 1–2 | 2–3 | 3–4 | 4–5 | Sum |
|---|---|---|---|---|---|
| 9–14 | 6 | 3 | – | – | 9 |
| 15–20 | 15 | 10 | 9 | 10 | 44 |
| 21–26 | 10 | 12 | 16 | 13 | 51 |
| 27–32 | 5 | 13 | 13 | 9 | 40 |
| 33–38 | 7 | 4 | 3 | 6 | 20 |
| 39–44 | 3 | 3 | 5 | 4 | 15 |
| 45–50 | – | – | – | 4 | 4 |
| 51–56 | – | 1 | – | – | – |
| 57–62 | – | – | – | – | – |
| Sum | 46 | 46 | 46 | 46 | 184 |
| Mean length of interval | 24.3 | 26.7 | 27.3 | 29.4 | 26.9 |

The mean length of the interval increases with the order of birth. Is this a spurious effect, or are the observed differences statistically significant? The same question also arises with respect to differences among individual families.

The internal variances of the aggregate of 46 families can be hypothesized as arising from a population of families which is homogeneous in respect of this variance; an analysis of variance, therefore, is to the point. It furnishes these results:

| Source of Variation | Sum of Squares | Degrees of Freedom | Mean Variance |
|---|---|---|---|
| Among families | 7.147 | 45 | 172 |
| Among birth orders | 619 | 3 | 206 |
| Residual | 5.360 | 135 | 39.7 |
| TOTAL | 13.726 | 183 | |

The ratio of the mean variance among families to the mean variance of the residual is much greater than required at the 5-per cent probability level, showing that inter-family differences are significant. The same holds for the ratio of mean variances for birth orders and the residual.

It follows that neither the inter-family nor the intra-family differences of intervals can be explained as merely accidental: if the normal birth intervals, 1-2 to 4-5, could be observed again and again in each family, differences among families, and intervals within the families, will subsist.

In summary:

1. Some couples are more likely than

others to bear children within short intervals.

2. Among the families of Crulai intervals between successive confinements tend to increase with the order of birth. The particular birth order has an effect whose real cause might be the preceding number of pregnancies as such, or the age of the mother, since birth order and mother's age are correlated. The small number of observations does not permit ascertaining whether birth order itself, or mother's age, is the principal determinant.

Decreasing, artificially, the intervals 2-3 by 2 months, intervals 3-4 by 3 months, and intervals 4-5 by 5 months (i.e., by the excess of their averages over the average of interval 1-2), the following distributions are obtained:

| Length of interval (completed months) | Normal birth interval of order: 1–2 (as given) | 2–3 (shortened) | 3–4 (shortened) | 4–5 (shortened) |
|---|---|---|---|---|
| 9–14 | 6 | 4 | 6 | 6 |
| 15–20 | 15 | 14 | 11 | 13 |
| 21–26 | 10 | 9 | 14 | 12 |
| 27–32 | 5 | 13 | 8 | 6 |
| 33–38 | 7 | 3 | 5 | 4 |
| 39–44 | 3 | 2 | 2 | 4 |
| 45–50 | – | – | – | 1 |
| 51–56 | – | 1 | – | – |
| Sum | 46 | 46 | 46 | 46 |
| Mean length of interval | 24.3 | 24.7 | 24.3 | 24.4 |

The four distributions are now very similar. Graphically speaking, the effect of birth order, or mother's age, results in a wholesale displacement of distributions to the right rather than in a flattening of the curves through widening in the direction of intervals of greater length.

In previous studies of populations practising no birth control, the effect of birth order has seemed to be negligible. This appeared to be the case with families of the leading class of Geneva at the end of the sixteenth and the beginning of the seventeenth century, and with the French Canadians who married in the early part of the eighteenth century. If the effect of the birth order is not the same among different populations, it is probable that it varies also within a given population; in other words, the different families are not equally affected by birth order.

A further extension of this reasoning would lead one to try to account for the spectrum of each family's successive birth intervals by variations of the effect of birth order. Because of the manifold combinations of variations in the several separate intervals, an orderly effect of birth order can scarcely be expected to emerge. From such complex analysis, logical satisfaction could hardly be obtained.

It is more practical to posit some underlying biological mechanism which tends to augment intervals between confinements in direct relation to the number of preceding pregnancies, or the mother's age.

In the absence of birth control, marital fertility and, hence, intervals between confinements depend mainly on three factors.

1. The woman's fecundability, defined as the probability that she will conceive in the course of one menstrual cycle or, say, within one month.

2. The frequency of uninduced miscarriages and still-births, since confinements resulting in live births only are here under consideration.

3. The time lapse between a confinement and the next onset of ovulation.

In the period beginning with a conception and ending with the next onset of ovulation, fecundability is zero. Hence, we are concerned with fecundability in periods other than these.

The biological mechanism suggested here may affect fecundability, the frequency of uninduced abortions, or the time lapse until ovulation is resumed. In the first event, an increasing dispersion and skewness towards long durations is to be expected for intervals of successively high order; in the third instance, birth interval distributions would be displaced towards the right without a significant change in their shapes. In the second of these three possi-

bilities, both types of effect should appear simultaneously. In other words, a constant shape of the successive birth interval curves occurs only if the biological action is of the third kind. This is very nearly the case observed here. It follows that the biological reason behind these observations seems to be an increasing delay in the resumption of ovulation with successive births.

Other facts lead to the inference that a relation exists between lactation and *post-partem* sterility. But this relation is subject to widely varying degrees of strictness: it may be nil for some women and absolute for some others; the latter would be women who do not ovulate for as long as they lactate. With women where this relation is absolute, it would appear already at the first confinement, or at an early age, to remain unaltered with successive pregnancies, or with increase in age; except for random effects, an unchanging individual trait is then revealed. With women for which the relation is loose at first, the suggested biological process would tend to strengthen it with time. In other words, the delay of ovulation caused by lactation would appear very early in some women, would tend to increase with successive pregnancies or rising age in others, and finally, perhaps, never arise in some.

**Dispersion of the Intra-Family Intervals**

Conception is a random process: there is merely a certain probability, called fecundability, that sexual relations will result in a conception. This conception, in turn, has only a certain probability to result in a live birth, or a confinement proper (other than an uninduced abortion, or miscarriage). The delay in the renewal of ovulation, finally, is subject to random variations.

For these several reasons, the intervals between confinements, or births, in a given family have a random dispersal around the expected variations resulting from birth order or age.[2]

This random dispersal is only a part of the residual variance met in the analysis of variance. If, as it appears to be, the effect of birth order or mother's age varies from one family to another, the residual variance includes another term due to such variation (cf. Appendix).

In practice, these two terms cannot be separated; the possible limits can only be set of the variance resulting from random causes, namely 24 and 40, to the nearest integral number. Its square root, the measure of dispersion, then ranges from 4.9 to 6.3 months. If the distribution of deviations approximates the normal, deviations will be smaller than two standard deviations in 95 per cent of the cases. In other words, the normal interval between successive confinements will only exceptionally deviate by more than 10 to 13 months from its expected value. But the expected value remains unknown.

Instead of dispersals around unknown expected values, the differences can be considered between any two consecutive intervals. The random variance about these differences is twice that considered in the foregoing, and the corresponding standard deviation is of between 7 and 9 months. So long as birth order, or age, has no effect, the absolute difference between two consecutive normal birth intervals should not exceed from 14 to 18 months in more than 5 per cent of the cases (it being assumed that the difference between successive intervals is likewise normally distributed.)

[2] Let it be assumed that fecundability outside the period of pregnancy and *post-partem* sterility is constant, equal to $p$; at the next onset of ovulation it equals $qp$, where $q = 1 - p$; at the third, it is $q^2p$, and so forth. The number of ovulations before a conception occurs averages $1/p$, with a *variance* equal to $q/p^2$. To this variance is added that of the number of ovulations which will not occur because of a conception; the latter variance depends, for a given woman, on variations in the duration of pregnancies and in the delay in resumption of *part-partem* ovulation.

In practice, of course, those differences between successive intervals will not be observed which result if birth order were of no effect. But the average effect of birth order, or mother's age, can be eliminated in terms of the difference in the means of the intervals. The variance about the differences is now no longer twice the sum of the variance caused by random processes and the variation caused by birth order; it is smaller[3] but still exceeds twice the variance from random causes only.

Assuming deviations in the observed differences about their mean to be normally distributed, their absolute value should not exceed in more than 5 per cent of the cases a value between $x$ and 18 months, where $x$ is greater than 14 and smaller than, if not equal to, 18.

The absolute difference, with respect to mean values, between intervals 1-2 and 2-3, and between intervals 3-4 and 4-5, is distributed as follows:[4]

| DIFFERENCE WITH RESPECT TO MEAN VALUES, IN NEAREST INTEGRAL NUMBER OF MONTHS | ADJUSTED NUMBER OF SUCH OBSERVED DIFFERENCES |
|---|---|
| Less than one month | 7 |
| 1 month | 10.5 |
| 2 months | 9.5 |
| 3 months | 9 |
| 4 months | 8 |
| 5 months | 6 |
| 6 months | 7 |
| 7 months | 5.5 |
| 8 months | 3 |
| 9 months | 2.5 |
| 10 months | 2 |
| 11 months | 2.5 |
| 12 months | 2 |
| 13 months | 3 |
| 14 months | 4 |
| 15 months | 2.5 |
| 16 months | 2.5 |
| 17 months | 2 |
| 18 or more months | 3.5 |
| All differences | 92 |
| Mean absolute difference | 7 months |
| Estimate of variance in the distribution of differences | 80 |
| | —standard deviation: 8.9 |

An absolute difference of 18 or more months occurs in fewer than 4 per cent of the cases, but in nearly 16 per cent of the cases differences are of 14 or more months; the difference corresponding to the 5 per cent level falls well within the limits which have been conceived but is near the upper of the two limits.

**Inter-family differences**

The distribution of intra-family means of the first 4 normal intervals is the following:

| | |
|---|---|
| 9–14 months | 0 |
| 15–20 months | 10 |
| 21–26 months | 15 |
| 27–32 months | 11 |
| 33–38 months | 9 |
| 39–44 months | 1 |
| | 46 |

Its general mean is 26.9; the estimated variance of this distribution, 172 divided by 4, is 43.0, and the standard deviation is 6.6 months.

The distribution of the means of the first 4 normal intervals appears to be skew

[3] The effect of birth order on a given interval is positively correlated with the effect of birth order on the subsequent interval.

[4] This distribution has been obtained as follows:

1. All intervals, in completed months, 1-2 are increased by the nearest integral number of months of the difference between the mean of interval 2-3 and the mean of interval 1-2; the same is done with the pair of intervals 3-4 and 4-5.

2. For each family the difference between interval 1-2 thus increased, and interval 2-3 is taken. The same is done with respect to intervals 3-4 and 4-5.

3. The distribution of these gross differences (i.e., in completed months) is then tabulated. The first (zero) are differences in true value smaller than 1 month; the second (1) are differences of from 1 day to 1 month and 29 days (for months having 30 days), etc. The distribution in true value (actual nearest integral number of months) is obtained by adding to the above category "zero" one-half the number in the above category "1," for the new 1-month category; for the remaining categories, the arithmetic mean of the corresponding gross categories (completed months) is taken in each instance for the new category (nearest integral number of months).

The distribution so obtained cannot very strictly be a normal distribution; actually, in the present instance, it differs only slightly from a normal distribution.

but is only slightly so, the median interval being 26.2 months. It can still, somewhat roughly, be assumed that 95 per cent of the cases occur in a range of 4 standard deviations centered about the mean, i.e., between 14 and 40 months. In the present instance, this range in fact covers more than 95 per cent of the cases, only one observation falling without it.

The estimated variance of the mean of the 4 intervals is the sum of:

1. the variance of the expected value of the mean

2. one-quarter the variance due to random processes

The first of these has been put between the limits 33.1 and 37.1 (cf. Appendix); the corresponding standard deviations are 5.75 and 6.1 months. The limits are close, and 6 may be substituted as an approximate estimate.

For each family, there is an expected value of the mean of the first four intervals, characterizing the couple's procreative ability;[5] this shall be referred to as the characteristic interval. Its mean is estimated at 27 months, the rounded arithmetic mean of the 46 observed intra-family means of the first four normal intervals. We can presume that the distribution of this characteristic interval approximates the normal; accordingly, the characteristic interval will only rarely be either smaller than 15, or larger than 39, months. In other words, for the families of Crulai which have had 6 or more children, the interval characterizing their procreative ability is practically contained within a range extending by two years, from about 1½ years to about 3½ years.

The lower limit of the characteristic interval corresponds to women whose ovulation is resumed no later than 6 months after termination of pregnancy. Even then, fecundability would have to be practically equal to unity. With only average fecundability, a characteristic interval of only 15 months implies a very rapid resumption of ovulation. The upper limit of the range corresponds to women of either low fecundability or long periods after confinement before ovulation is resumed.

Observations other than those presented here tend to confirm that this range of procreative ability reflects very largely the range in delays of *post-partem* resumption of ovulation.[6] Since, in a rural environment, women ordinarily breast-feed their children, the varying delays in the resumption of ovulation reflect variations in the influence of lactation on ovulation, as well as variations in the length of the period of lactation. Women with the shortest characteristic intervals show no effect of lactation on ovulation. Women with long characteristic intervals not only prolong lactation over a considerable period but also show a prolonged interference of lactation with ovulation.

**Summary**

For the present study use has been made of data on 46 families found at Crulai, a village in Normandy, between 1674 and 1742. These 46 families have had at least 6 children, and their first 4 intervals between confinements were normal (i.e., the child born at the last previous confinement has lived for at least 12 months). By the procedure adopted, the effect of infant mortality on birth intervals has been eliminated.

This small sample has sufficed to reveal that birth order, or mother's age, has a certain effect, and that there is a very clear variation in procreative ability among families.

[5] The word "aptitude," in the French original, designates ability not in the sense of sheer physical capacity but also takes into account natural disposition, or other conditioning circumstances, as a result of which performance ordinarily does not necessarily attain sheer capacity. (Translator's note)

[6] Louis Henry, *Anciennes familles Genevoises* (Historic Genevese Families) Travaux et Documents of the Institut national d'études demographiques, Presses Universitaires de France, 1956, p. 138. A similar observation has also been made at Crulai.

## TABLE I

NORMAL INTERVALS BETWEEN SUCCESSIVE CONFINEMENTS

Women married at Crulai (Normandy) from 1674 to 1742, with at least 6 confinements during the marital life.

| Families No. | Interval between confinements (in completed months) 1–2 | 2–3 | 3–4 | 4–5 | Mean interval (months) | Internal variation Variance | Internal variation Standard deviation (months) |
|---|---|---|---|---|---|---|---|
| 1 | 17 | 17 | 16 | 20 | 18 | 3 | 1.73 |
| 2 | 33 | 32 | 32 | 29 | 32 | 3 | 1.73 |
| 3 | 20 | 20 | 15 | 18 | 18.75 | 5.67 | 2.39 |
| 4 | 34 | 34 | 39 | 37 | 36.5 | 6 | 2.45 |
| 5 | 16 | 20 | 22 | 18 | 19.5 | 6.67 | 2.58 |
| 6 | 19 | 23 | 17 | 21 | 20.5 | 6.67 | 2.58 |
| 7 | 24 | 29 | 25 | 23 | 25.75 | 7 | 2.65 |
| 8 | 34 | 30 | 28 | 29 | 30.75 | 7 | 2.65 |
| 9 | 14 | 12 | 19 | 17 | 16 | 9.67 | 3.11 |
| 10 | 29 | 30 | 25 | 23 | 27.25 | 11 | 3.33 |
| 11 | 21 | 17 | 17 | 24 | 20.25 | 11.67 | 3.41 |
| 12 | 22 | 17 | 26 | 23 | 22.5 | 14 | 3.74 |
| 13 | 21 | 24 | 15 | 17 | 19.75 | 16.33 | 4.04 |
| 14 | 32 | 36 | 26 | 35 | 32.75 | 20.33 | 4.51 |
| 15 | 25 | 20 | 29 | 30 | 26.5 | 20.67 | 4.54 |
| 16 | 21 | 20 | 30 | 26 | 24.75 | 21.67 | 4.65 |
| 17 | 31 | 30 | 40 | 36 | 34.75 | 21.67 | 4.65 |
| 18 | 14 | 19 | 23 | 26 | 21 | 27 | 5.20 |
| 19 | 15 | 21 | 28 | 23 | 22.25 | 29 | 5.39 |
| 20 | 13 | 22 | 21 | 26 | 21 | 29.67 | 5.45 |
| 21 | 12 | 19 | 26 | 21 | 20 | 33.67 | 5.80 |
| 22 | 20 | 13 | 22 | 27 | 21 | 33.67 | 5.80 |
| 23 | 14 | 21 | 28 | 18 | 20.75 | 35 | 5.92 |
| 24 | 24 | 34 | 37 | 27 | 31 | 36.33 | 6.03 |
| 25 | 15 | 21 | 30 | 23 | 22.75 | 38.33 | 6.19 |
| 26 | 26 | 24 | 28 | 38 | 29.5 | 38.67 | 6.22 |
| 27 | 18 | 28 | 18 | 30 | 24 | 41 | 6.40 |
| 28 | 15 | 29 | 25 | 28 | 24.75 | 41 | 6.40 |
| 29 | 34 | 35 | 23 | 39 | 33.25 | 47 | 6.86 |
| 30 | 38 | 54 | 41 | 42 | 44.25 | 49.67 | 7.05 |
| 31 | 43 | 31 | 31 | 44 | 37.75 | 52.33 | 7.23 |
| 32 | 18 | 22 | 35 | 24 | 25.25 | 53 | 7.28 |
| 33 | 36 | 31 | 23 | 20 | 28 | 53.67 | 7.33 |
| 34 | 32 | 41 | 30 | 46 | 37.75 | 57 | 7.55 |
| 35 | 36 | 32 | 31 | 48 | 37.25 | 61 | 7.81 |
| 36 | 12 | 30 | 15 | 17 | 19 | 63 | 7.94 |
| 37 | 40 | 25 | 29 | 42 | 34.5 | 68.67 | 8.29 |
| 38 | 15 | 15 | 26 | 32 | 22.5 | 71.33 | 8.45 |
| 39 | 19 | 24 | 19 | 37 | 25.25 | 72.33 | 8.51 |
| 40 | 43 | 30 | 22 | 26 | 30.75 | 83 | 9.11 |
| 41 | 23 | 42 | 42 | 29 | 34.5 | 91.33 | 9.58 |
| 42 | 28 | 13 | 36 | 20 | 24.75 | 99 | 9.95 |
| 43 | 17 | 40 | 23 | 35 | 29.25 | 112.33 | 10.60 |
| 44 | 25 | 26 | 32 | 48 | 33.25 | 113 | 10.63 |
| 45 | 17 | 28 | 43 | 23 | 28.25 | 123.67 | 11.12 |
| 46 | 20 | 26 | 24 | 47 | 29.75 | 146.33 | 12.09 |
| 47 | 13 | 26 | 29 | 53 | 30.75 | 278.33 | 16.68 |
| 48 | 17 | 19 | 53 | 23 | 28.5 | 284 | 16.85 |
| 49 | 16 | 19 | 57 | 43 | 34.25 | 386.33 | 19.65 |
| 50 | 14 | 45 | 56 | 20 | 34.25 | 400.33 | 20.01 |

Intervals between successive confinements tend to increase with the order of confinement; the increase is by about 5 months, i.e., by about one-fifth, from the interval between the first and second birth to the interval between the fourth and fifth birth. This increase appears to be attributable to an increasing delay in the resumption of ovulation after a confinement.

Birth order is the apparent cause and may, conceivably, be the real cause; but the cause may also be the age of the mother, birth order and age being correlated. The data do not bear out which of the two is the principal factor.

This effect of birth order, or of age, has not been observed so far in the study of historic populations. It is probable that the effect is also variable among the individual families of Crulai. Intra-family variations of birth intervals, at any rate, are mainly caused by random processes. The standard deviation from random causes is one of 5 or 6 months, and the coefficient of variation is of the order of 20 per cent.

Despite its smallness, analysis of this sample shows a marked diversity in individual procreative abilities. Such diversity is probably common to all human populations. The interval which characterizes procreative ability varies from about 15 to about 39 months.

These differences are probably a result of individual differences in the time lapse until ovulation is resumed; the latter differences, in turn, are likely to result from marked differences, among individual women, in the extent to which lactation interferes with ovulation.

## APPENDIX

Let $n$ be the number of families studied, regarded as a sample drawn from an infinite population of families (population matrix). Let $x_{ij}$ denote the normal interval between confinements of orders $j$ and $j+1$ in family $i$ (where $i$ varies from 1 to $n$, and $j$ from 1 to 4).

$x_{ij}$ depends on several factors: the family $i$, the order $j$, and chance.

The effect of birth order may be common to all families, but may also vary from one family to another; the effect may even be absent in some families and more than average in some others. But since for each family the same normal intervals (i.e. the first four) are considered, the effect of birth order may be regarded as nothing more than the difference, relative to the expected value of the mean of the first 4 intervals, in the expected value of the interval between confinements of order $j$ and $j+1$. If this effect be denoted by $r_{ij}$, then $\sum_j r_{ij} = 0$.

Denoting by $x_i$ the expected value of the mean of the first 4 intervals of family $i$, and by $\xi_{ij}$ a random variable of expected value zero, one may write:

$$x_{ij} = x_i + r_{ij} + \xi_{ij}.$$

We use the following notation:

$x$ is the mean of $x_i$ in the sample of $n$ families,

$\bar{x}_i$ is the mean of the observed first four normal intervals of family $i$,

$\bar{x}_j$ is the mean of the observed $n$ intervals of order $j$,

$\bar{\bar{x}}$ is the general mean of all observed intervals,

$\bar{\xi}_i$ is the mean of $\xi_{ij}$ in family $i$,

$\bar{\xi}_j$ is the mean of $\xi_{ij}$ in respect of birth order $j$,

$\bar{\bar{\xi}}$ is the general mean of all values of $\xi_{ij}$

$r_j$ is the mean of the $n$ effects, $r_{ij}$, in respect of birth order $j$.

The following relations hold:

$$\bar{x}_i = x_i + \bar{\xi}_i,$$
$$\bar{x}_j = x + r_j + \bar{\xi}_j,$$
$$\bar{x} = x + \bar{\xi}.$$

In the analysis of variance, the sum of squares of deviations among families equals:

$$4\sum_i (\bar{x}_i - \bar{x})^2 = 4\sum_i (x_i - x)^2 + 4\sum_i (\bar{\xi}_i - \bar{\xi})^2.$$

We denote by $V_x$ the variance of $x_i$ in the population matrix and by $V_\xi$ the variance of $\xi$; the expected value of the sum of squares equals:

$$(n-1)[4V_x + V_\xi].$$

The sum of squares of deviations in respect of birth order equals:

$$n\sum_j (\bar{x}_j - \bar{x})^2 = n\sum_j r_j^2 + n\sum_j (\bar{\xi}_j - \bar{\xi})^2.$$

We denote by $V_r$ the variance of $r_j$ in the population matrix; the expected value of the sum of squares of deviations among birth orders equals:

$$4(n-1)V_r + 3V_\xi.$$

The total variance is calculated as follows:

$$\sum_i \sum_j (x_{ij} - \bar{x})^2 = \sum_i [\sum_j (x_{ij} - \bar{x}_i)^2 + 4(\bar{x}_i - \bar{x})^2]$$
$$= \sum_i \sum_j r_{ij}^2 + \sum_i \sum_j (\xi_{ij} - \bar{\xi}_i)^2 + 4\sum_i (\bar{x}_i - \bar{x})^2.$$

If we put $r_{ij} = r_j + \rho_{ij}$,

$$r_{ij}^2 = r_j^2 + 2r_j\rho_{ij} + \rho_{ij}^2$$
$$\sum_i \sum_j r_{ij}^2 = n\sum_j r_j^2 + \sum_i \sum_j \rho_{ij}^2$$

hence:

$\sum_i \rho_{ij}^2$ equals $(n-1)$ times the variance of the effect of birth order $j$. Let us designate as $V_\rho$ the mean of the four variances corresponding to the 4 birth orders, 1 to 4.

The expected value of the sum of squares equals:

$$4(n-1)V_x + 4(n-1)(V_r + V_\rho) + (4n-1)V_\xi.$$

By subtraction one obtains the sum of squares in respect of the residual variation, which equals:

$$4(n-1)V_\rho + 3(n-1)V_\xi.$$

The residual variation, thus, depends on the random factor and on the inter-family variation of the effect of the birth order.

The 4 variances, $V_x$, $V_r$, $V_\rho$, and $V_\xi$, are interrelated by three linear equations; furthermore, unless zero, they all must be positive; any combination of four positive values or zero satisfying the three equations is a solution. One such solution is obtained by making $V_\rho$ equal zero: this corresponds to the case where the effect of birth order is the same for every family. This assumption, which is implausible, would result in a maximum of $V_\xi$.

Another limit of $V_\xi$ is obtained on the assumption that the effect of birth order is in the same direction, but of varying intensity, among the several families. In this event, such decreases in birth intervals as one might observe from one order to the next can result only from randomness in the rates of conception and accidental variations in the lapse of time until renewal of the ovulation.

To take these into account, let us use that expression of the variance which is based on the squares of differences, within each of two pairs of observed values, instead of the squares of deviations about the mean.

Let there be $n$ observed values, $x_i \cdots x_j \cdots x_k \cdots x_n$, with $\bar{x}$ their mean, then:

$$\sum_i (x_j - \bar{x})^2 = \frac{1}{n} \sum_{j=1}^{j=n} \sum_{k=j+1}^{k=n} (x_j - x_k)^2$$

From this, the variance, $V$, is estimated:

$$V = \frac{1}{n(n-1)} \sum_{j=1}^{j=n} \sum_{k=j+1}^{k=n} (x_j - x_k)^2$$

Thus, for each family the internal variance can be calculated by dividing by 12 the sum of the 6 differences within each of two pairs of the 4 observed normal intervals; the mean internal variance is then equal to the mean of the 46 values so obtained.

Let us consider family $i$ and orders $j$ and $k$, where $j < k$. One may write:

$$\Delta x = x_{ik} - x_{ij} = r_{ik} - r_{ij} + \xi_{ik} - \xi_{ij} = \Delta_r + \Delta\xi.$$

By assumption, $r$ is positive or zero. When $\Delta x$ is negative, $\Delta_\xi$ must also be negative so that, denoting negative variances by $\Delta_n$:

$$|\Delta_n \xi| = |\Delta_n x| + \Delta_r \geqslant |\Delta_n x|.$$

The distribution of $\Delta\xi$ is symmetrical, the pair of random differences, $\xi_k$ and $\xi_j$ occurring with equal likelihood as the pair $\xi_j$, $\xi_k$.

For negative variations in $x$, due to negative differences $\Delta_n\xi$, there are an equal number of positive variations in $x$, due to opposite differences in $\Delta\xi$.

One may then write:

$$\sum\sum(\Delta\xi)^2 \geqslant 2\sum\sum(\Delta_n x)^2.$$

For the 46 families under consideration,

$$2\sum\sum(\Delta_n x)^2 = 13162,$$

hence,

$$V_\xi \geqslant \frac{13162}{12 \times 46} = 23.8.$$

Likewise, $V_\xi \leqslant 39.7$

On the other hand, since $n = 46$,

$$45(4V_s + V_\xi) = 7747$$

$$180V_r + 3V_\xi = 619$$

$$180V_\rho + 135V_\xi = 5360.$$

Hence, finally,

$$23.8 \leqslant V_t \leqslant 39.7$$

$$33.1 \leqslant V_s \leqslant 37.1$$

$$2.8 \leqslant V_r \leqslant 3.0$$

$$0 \leqslant V_\rho \leqslant 11.9.$$

Intra-family intervals vary from two sources: random sources with variance $V_t$; and the effect of birth order which varies among families. The variance of the latter is $V_r + V_\rho$. The latter sum, rounded to the nearest integer, is between 3 and 15.

Variations due to birth order are small relative to dispersals caused by chance.

# CURRENT THEORIES ON THE ETIOLOGY OF MONGOLISM

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THEORIES ON THE ETIOLOGY OF MONGOLISM are generally couched in terms of either genetic or nongenetic causation. This tendency is likely to obscure the implications of data that support either alternative, since various findings are consistent with both interpretations. The apparent diversity is even compatible with the hypothesis that mongolism is not a single etiological entity. It may be a trait complex which includes genetic as well as nongenetic forms. Harelip and cleft palate are congenital defects illustrating this etiological variation (13).

With a frequency of about one in 700, mongolism is one of the most common mental deficiency syndromes and accounts for 10 per cent of the admissions to New York State schools for the retarded. According to Benda (3, 5), the condition is a central growth disorder characterized as congenital hypopituitarism. The skeletal system, which is the area of major involvement, shows pathological growth of both skull and extremities. Onset of the defect is associated with the eighth week of fetal life because it is at this embryonic stage that the affected structures differentiate (10).

Early proponents of a genetic causation based their conclusions primarily on twin data. Recent disclosure of the presence of a dermatoglyphic pattern characteristic of mongolism in the relatives of mongoloids, and the birth of mongoloids to mongoloid mothers lent significant support to this point of view. Exponents of a nongenetic etiology stressed especially the well-established relationship between mongolism and maternal age, the syndrome being produced by noxious agents interfering with fetal nutrition during the pre-placental period.

### Twin Data

Early observations based on twin studies came either from small series of twins or from single case reports. Although over 100 instances of mongolism in twins had been reported, the evidence for zygosity classification was insufficient in about one-third of them (8). The results pointed to complete concordance in one-egg twins, and to almost complete discordance in two-egg pairs. In a presumably monozygotic pair of South African twins, discordant as to mongolism, the zygosity diagnosis was made on the basis of the absence of a chorion in the placenta (6), but an opposite-sex pair is on record as having no separating membranes (17).

Twin concordance rates derived mainly from the literature are obviously not sufficient to substantiate a genetic theory of mongolism. Furthermore, the application of concordance estimates presupposes that one-egg and two-egg pairs are equally susceptible to the condition. A difference in susceptibility in itself might have a bearing on the etiology.

In a more recent study of a statistically representative series of mongoloid twins

and their siblings (1), concordance was observed in 3 one-egg pairs, and discordance in 23 two-egg pairs. As a group, twins did not seem to be more or less susceptible to the condition than non-twins. In comparing the non-mongoloid cotwins with their siblings, no significant mongoloid trend emerged in either group. This absence of mongoloid traits in the dizygotic twin partners of mongoloids weakens the hypothesis that the defect is solely a reflection of an abnormal intrauterine environment.

In Benda's opinion (4), discordance in two-egg pairs is explained by the fact that they occupy different implantation sites. Although the same situation exists in 15 per cent of one-egg twins, the occurrence of discordance in this group has yet to be confirmed. Of course, the total number of one-egg twins with a verified mongoloid syndrome is still relatively small, so that the implantation site hypothesis cannot as yet be regarded as refuted.

Allen and Kallmann (2) attached etiological significance to the observation that mongoloid traits did not differ appreciably between two-egg cotwins of mongoloids and their sibs. They believe that if subclinical manifestations tended to result from intrauterine effects, such changes would occur with greater frequency in the cotwins than in the sibs of mongoloids. Conversely, were subclinical signs to depend on genetic factors, the frequency for cotwins would not differ from that of their sibs. With the available data supporting the latter hypothesis, the investigators assumed that mongolism results from the damaging effect of a defective maternal reproductive system on (*a*) a genetically susceptible embryo, or (*b*) the ovum, or (*c*) the embryo prior to the earliest stage when twinning occurs.

The hypothesis that the embryo is vulnerable to mongolism before the cell division which results in twinning (prior to the time of nidation) is of particular interest. It would account for the consistent tendency for concordance in one-egg twins, regardless of the specific nature of the vulnerability. This appears to have been the primary consideration in formulating the defective ovum theory (11, 18).

From a genetic standpoint, vulnerability prior to nidation and pathological changes in the eighth week of gestation are not mutually exclusive. Gene action seems to observe a timetable which covers the life span of the individual. Some hereditary defects, such as cleft palate and harelip, are present at birth, while Tay-Sachs disease is not manifest until the age of six months, and Huntington's chorea is usually not apparent until the mid-thirties.

**Familial Incidence**

Familial incidence estimates have been less consistent than twin data. Earlier investigators found no increased morbidity risk in mongoloid sibships. More recently, morbidity studies were focused on the expectancy rate for sibs born after the mongoloid, with the observed sibship risk figures varying from 1 to 14 per cent (7, 14, 15). The highest morbidity rate (14 per cent) was found in sibships recorded in the literature and is, therefore, not based on a valid sample. Apparently, the expectancy rate for sibs born after the mongoloid does not exceed 4 per cent. Indeed, the risk may not be any greater than that for children born to older mothers who have not given birth to mongoloids (1-2 per cent). Although sibships with as many as five mongoloids have been reported (21), the tendency to familial concentration seems to be rather low, pointing to the participation of nongenetic factors in the total mechanism of causation.

The old notion that mongoloid females were sterile blocked one of the more obvious avenues of approach for genetic analysis. Actually, seven instances of reproduction in a mongoloid have been recorded. Of the seven children, five were normal and two mongoloid (12, 19). According to one

hypothesis, the duplication of the mother's defect in the child is due to impaired maternal endocrine function. This explanation does not suffice, however, to account for the birth of normal children to mongoloids whose endocrine system would be assumed to be impaired to the same extent as that of their "less fortunate" counterparts. It is more plausible, therefore, to think of a mode of causation that includes a gene-specific differential fetal susceptibility.

**Dermatoglyphics**

Among the dermatoglyphic anomalies common in mongolism, of particular interest is the position of the palmar triradius (16), a feature that is assumed to be largely gene-specific under normal as well as abnormal conditions. Ordinarily found in the heel of the hand, the triradius of mongoloids is placed near the center of the palm. While this change in location is part of the symptomatology of mongolism, the triradial site has not been shown to bear a relationship to variation in maternal age.

A clear association has been established between the central (mongoloid) location of the triradius and the frequency of this genetically determined trait in the families of mongoloids (16). The mongoloid type of location has been shown to vary from a rate of 11 per cent for the parents and sibs of non-mongoloids (2,046 individuals) to a rate of 18 per cent for the parents and sibs of mongoloids (736 individuals). Even more impressive was the finding that the given rate for the parents and sibs of mongoloids showed a further increase when the number of mongoloids per sibship was taken into account. The observed figures were 16.9 per cent for sibships with one mongoloid (673 individuals) and 36.5 per cent for those with two mongoloids (63 individuals). The differences among the three groups of families were statistically significant and formed one of the most important pieces of evidence for a direct link between gene-action and mongolism.

**Maternal Age Effect and Genetic Analogues**

Apart from the apparently consistent trend toward concordance in one-egg twins, a striking aspect of the disorder is its relationship to maternal age. The condition tends to occur most frequently in older mothers who have a history of previous miscarriages as well as a period of infertility prior to the mongoloid birth. The nature of the underlying reproductive deficiency, however, has yet to be delineated. A thyroid dysfunction has been postulated but not confirmed.

Specific effects of maternal age on genetically determined traits such as polydactyly have been described in guinea pigs and mice, with penetrance reduced in older mothers (9, 22). In the guinea pig the frequency of white spotting is increased with maternal age (20). These illustrations of the effect of maternal age on the expression of a genetic trait may be paralleled in mongolism.

**Etiological Problems**

Three major questions require clarification in understanding the cause or causes of mongolism:

1. What is the primary pathological substrate?
2. What is the nature of the reproductive deficiency in the maternal organism?
3. What is the origin of varying degrees of susceptibility to early damage in the fetus?

At present, no definitive answer is available to any of these questions. However, as is indicated by the accumulated findings, the etiology of this syndrome apparently requires both a gene-specific vulnerability and an unfavorable intra-uterine milieu. The genetic mechanism involved is not likely to be a simple one, since the low familial incidence rate militates against a single-factor type of inheritance. Equally implausible is the theory of a new single-

factor mutation for every case of mongolism. In this instance, the mutation rate observed would be much higher than is actually seen for spontaneous mutations under controlled conditions. Involvement of sex-linked genes can also be precluded, because there is no evidence of unequal sex distribution.

**Summary**

Of the etiological background factors in mongolism considered here, the pronounced difference in concordance between one-egg and two-egg twins, certain dermatoglyphic similarities between mongoloids and their parents and sibs, and the fact that some mongoloid mothers have had a mongoloid child point to a gene-specific mechanism. The low familial concentration indicates the participation of nongenetic factors in the variability of penetrance. Apparently these factors are associated with maternal age, specifically, with the state of health of the intrauterine environment prior to nidation.

In conclusion, it may be said that mongolism is associated with a specific period of fetal development, and that its potentiality exists in the embryo prior to the division that results in twinning.

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# CONTRACEPTION AND CATHOLICISM IN JAMAICA

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IN A PREVIOUS INVESTIGATION in Puerto Rico we found that Catholics were usually indistinguishable from non-Catholics in attitudes and practices regarding fertility control.[1] Indeed, where differences appeared, Catholics were almost invariably more liberal than non-Catholics. One hypothesis advanced to account for this anomalous finding was that Catholicism for the average lower class Puerto Rican is largely nominal. Protestantism, on the other hand, because of its minority status and the relatively recent conversion of its members, tends to be taken more seriously by its adherents who may adopt a fairly conservative position as regards family relations.

In Jamaica we have precisely the reverse circumstance. Catholics represent less than a tenth of the population, while the bulk of the population is traditionally Protestant. It will therefore be of particular interest to see whether the minority status of the Catholic in Jamaica has produced a closer adherence to Catholic teaching with respect to family planning.

It must first be noted, however, that in fact the lower class Jamaican Catholic in our sample[2] is *not* conspicuously fervid in a general sense. Less than a third of the Catholic women in our sample (which included only women with current sexual partners) are married—the remainder are from a religious point of view "living in sin." Only about a fifth attend church services weekly, despite the fact that under ordinary circumstances missing church on Sunday entails a mortal sin for a Catholic. Finally, fewer Catholics than non-Catholics said that religion was "very important" to them. Because of these facts, it would seem preferable not to treat Catholics as a group but to divide them into different classes to see whether any differentiation of attitude exists among them. We shall do this in several different ways—according to religious affiliation of the woman's partner; according to the respondent's church attendance; according to her marital status (as a measure of her religiosity) and according to her exposure to modern ideas (as judged by her education and residence). Because of the small number of Catholic women in the sample we shall have to make each of these classifications independently of the others.

There are 59 cases in the present sample

[1] J. Stycos, K. W. Back and R. Hill, "Contraception and Catholocism in Puerto Rico," *The Milbank Memorial Fund Quarterly*, April 1956.

[2] The data here reported were collected by a team of female Jamaican interviewers in 1956. The survey consisted of an island-wide sample of 1340 women chosen to be representative of urban, rural and townswomen meeting certain criteria of age (between 14 and 40); marital status (mated, whether married, common law or in regular liaison); and class (a maximum of elementary school education). Because oversampling of towns and urban areas was employed, the deck of Hollerith cards was "weighted" to adjust for the deficiency in proportion rural, increasing the number of cards by about 40 per cent. Throughout this paper, a "w" signifies that the weighted deck was used.

TABLE 1
SELECTED VARIABLES ACCORDING TO RELIGIOUS AFFILIATION OF COUPLES

| | *Both Partners R.C.* | *One Partner R.C.* | *Neither Partner R.C.* |
|---|---|---|---|
| A. Preferred Family Size (Md.) | 3.7 | 3.2 | 3.8 |
| B. Knowledge of Birth Control (Md. Score) | 10.8 | 11.8 | 9.0 |
| C. Attitude Toward Birth Control | | | |
| 1. % Say "Everybody Has Right to Use Birth Control" | 22 | 23 | 14 |
| 2. % Approve of Birth Control. | 53 | 56 | 51 |
| 3. % Would Take Oral Pill | 67 | 70 | 72 |
| 4. % Approve of Spacing | 93 | 89 | 88 |
| D. Use of Birth Control (% Ever Used) | 16 | 14 | 12 |
| E. Fertility Rate (Md. Pregnancies Per 10 Exposure Yrs.) | 2.46 | 2.64 | 2.96 |
| N. | (59) | (126) | (1182) |

in which both partners are Roman Catholic and 126 cases in which one partner is a Catholic. These two groups, as well as the remaining groups in which neither partner is Catholic are shown in Table 1. It can be seen that on measures of knowledge, attitude and practice with respect to family planning, the Catholics are virtually identical with non-Catholics, and that it makes very little difference whether only one partner or both partners are Catholic.[3] What slight differences exist tend to be in the unexpected direction. For example, the fertility rate of the non-Catholics is about 20 per cent higher than that of Catholic couples, and Catholics in general score considerably higher on knowledge of birth control.

Since Catholic affiliation by itself, regardless of whether or not this applies to the couple, does not seem to discriminate on the foregoing items, we next divide the sample into broad denominational categories and subclassify these by frequency of church attendance. We shall term those who attend services once or more per month "faithful" and those who attend less frequently "casual." These data pertain to the females only, since church attendance was not recorded for males.

Although the differences are in most instances small, there is a general tendency for the Catholics and Protestant sectarians to be at the two extremes, with Protestant denominations falling in between. Catholics and sectarians tend to be, respectively, at the liberal and conservative poles. (It is pertinent to mention at this point that the sectarians were most likely to say religion was "very important to them," the Catholics the least likely.)

As between faithful and casual Catholics, differences are again minimal, with the exception of fertility. It is of interest that the faithful Catholics have by a considerable margin the lowest fertility, those with no religion the highest. The incidence of contraceptive experience is also highest among the faithful Catholics, but the difference between this group and others is too small to account for the differences in fertility.

These findings, so contrary to expectation, lead us to question further the nature of the groups whose attitudes and practices we have been examining. In Table 3 we have presented data on age, education, residence and marital status.

With the exception of the youth of those with no religion (which helps account for their high rates of fertility), age shows no variation. Those with no religion and the sectarians show lower educational levels, and the faithful Catholics show markedly higher educational levels than others. This same pattern is true for urban residence.

[3] Exceptions are seen in two instances. Couples with one Catholic partner stand out as small-family oriented and knowledgeable on birth control.

TABLE 2
SELECTED VARIABLES ACCORDING TO RELIGIOUS AFFILIATION AND FREQUENCY OF CHURCH ATTENDANCE

| | *Faithful* | | | *Casual* | | | *No Religion* |
|---|---|---|---|---|---|---|---|
| Preferred Family | Prot. Sect | Prot. Denomination | Roman Catholic | Prot. Sect | Prot. Denomination | Roman Catholic | |
| Size (Md.) | 4.8 | 3.8 | 3.6 | 3.7 | 3.8 | 3.5 | 3.7 |
| Knowledge of Birth Control Score (Md.) | 8.6 | 8.8 | 10.4 | 8.0 | 9.0 | 12.1 | 8.5 |
| Birth Control Attitude Score (Md.) | 5.3 | 4.2 | 4.0 | 3.8 | 3.7 | 3.5 | 5.3 |
| % ever used Birth Control | 12.0 | 12.0 | 17.5 | 11.0 | 12.0 | 12.0 | 5.5 |
| Fertility Rate (Md.) | 4.48 | 3.22 | 2.32 | 4.94 | 4.03 | 3.85 | 5.07 |
| N. (W) | (181) | (409 | (57) | (116) | (451) | (70) | (80) |

TABLE 3
BACKGROUND CHARACTERISTICS OF RELIGIOUS TYPES

| | *Faithful* | | | *Casual* | | | *No Religion* |
|---|---|---|---|---|---|---|---|
| | Prot. Sect | Prot. Denomination | Roman Catholic | Prot. Sect | Prot. Denomination | Roman Catholic | |
| Age (Md.) | 28.5 | 28.9 | 28.8 | 28.9 | 28.8 | 28.4 | 23.6 |
| Education (% 6th Standard) | 29.0 | 41.0 | 65.0 | 31.0 | 36.0 | 45.0 | 24.0 |
| Residence (% Urban) | 15.0 | 25.0 | 60.0 | 32.0 | 29.0 | 45.0 | 17.0 |
| Marital Status (% Married) | 44.0 | 33.0 | 29.0 | 30.0 | 22.0 | 30.0 | 11.0 |

The incidence of marriage is low among those with no religion (probably a function of the young age of this group) and somewhat high among the faithful denominationals. Other groups show little variation.

The foregoing data suggest the direction for further analysis. First, since marriage shows little relation to our measure of "faithfulness" to religion for Catholics (although it does for non-Catholics), it may be that church attendance is an inadequate measure of religiosity for Catholics. Consequently, we shall attempt a new classification, using marriage as the measure of faithfulness to Catholicism. Second, since Catholics, especially the faithful, are outstanding in terms of education and residence, our final classification scheme shall take these variables into account.

As seen in Table 4, using marriage as a measure of religiosity does not change the picture already presented. Indeed it tends to emphasize the anomalous difference between Catholics and Protestants. Catholics are seen as markedly more favorable to birth control than Protestants on one item, have higher knowledge scores, and lower fertility rates. Moreover, with the exception of preferred family size, married Catholics are no less liberal than those Catholics in illicit relationships. While their fertility is higher, this is a consequence of the greater fertility of all married couples.

We have seen that Catholics tend to be better educated than non-Catholics and are more likely to be urban in residence. This suggests that the explanation for the lack of difference between Catholics and others may be due to their relatively elite status within the lower class. That is, education and urban residence tend to make Catholics more liberal, and religion tends to make him more conservative as regards

TABLE 4
SELECTED VARIABLES ACCORDING TO MARITAL STATUS AND RELIGIOUS AFFILIATION

| | *Married* | | | *Non-Married* | | |
|---|---|---|---|---|---|---|
| | No. Rel.* | Prot. | R.C. | No. Rel. | Prot. | R.C. |
| Preferred Family Size (Md.) | | 4.1 | 4.1 | 3.8 | 3.7 | 3.3 |
| B. C. Knowledge Score (Md.) | | 8.2 | 11.3 | 8.4 | 9.0 | 11.1 |
| % Say Everybody Has Right to Use B. C. | | 14 | 35 | 11 | 13 | 20 |
| % Approve Birth Control | | 52 | 49 | 46 | 50 | 52 |
| % Ever Used Birth Control | | 14 | 15 | 1 | 10 | 13 |
| Fertility Rate (Md.) | | 4.07 | 3.69 | 5.16 | 3.56 | 2.77 |
| Age (Md.) | | 32.5 | 32.4 | 22.7 | 27.4 | 27.3 |
| N. (*W*) | (14) | (515) | (49) | (112) | (1159) | (119) |

*Too few cases for reliable comparison.

TABLE 5
SELECTED VARIABLES ACCORDING TO RELIGION AND ELITE STATUS

| | *Elite* | | *Other* | |
|---|---|---|---|---|
| | *Catholic* | *Non-Catholic* | *Catholic* | *Non-Catholic* |
| Preferred Family Size (Md.) | 3.3 | 3.2 | 3.5 | 3.9 |
| Knowledge of Birth Control Score (Md.) | 7.5 | 7.0 | 5.7 | 4.6 |
| % saying "Everybody Has Right to Use Birth Control" | 31 | 17 | 18 | 12 |
| % Approve of Birth Control | 59 | 61 | 52 | 48 |
| % Ever Used Birth Control | 23 | 20.5 | 7 | 9 |
| Fertility Rate (Md.) | 2.67 | 3.54 | 4.11 | 4.19 |
| N. (*W*) | (93) | (259) | (149) | (1496) |

family planning—the net effect being to put him at the same or slightly more liberal level than the non-elite, non-Catholic. To investigate this possibility, we have divided Catholics and non-Catholics into two groups—those who are of sixth-standard education and live in towns or in Kingston, and those who are of less than sixth standard or live in the country. The former will be called "Elite," the latter "Other."

The elite in general, regardless of religious affiliation, tend to have more liberal attitudes, to have practiced family planning and to have lower fertility than the non-elite. Catholics and non-Catholics do not show much differentiation when elite status is held constant, but where differences do occur, the Catholics again emerge as somewhat more liberal (e.g., in right to use birth control and knowledge score). Especially noteworthy is the low fertility of the Catholic elite, a factor which calls for further explanation.

This phenomenon cannot be accounted for in terms of marital status. The fertility of the married is considerably higher than that of the unmarried in our sample. The fact that 36 per cent of the Catholic elite but only 29 per cent of the non-Catholic elite are married makes the fertility discrepancy even more surprising. Moreover, the former contracted their first sexual unions (of three months or more duration) at a median age of 16.6, the latter at 17.1, and the average age of both groups is identical (29.5).

The only clue we have is the rather high rate of childlessness among the Catholic elite—25 per cent as opposed to 16 per cent of the non-Catholic elite, as seen in Table 6.

TABLE 6
INFERTILITY AND FERTILITY RATES OF RELIGIOUS ELITE TYPES

| | % Never Pregnant | Fertility Rate of Mothers (Md.) |
|---|---|---|
| Catholic Elite | 25 | 3.34 |
| Non-Catholic Elite | 16 | 3.65 |
| Catholic Other | 13 | 4.27 |
| Non-Catholic Other | 11 | 4.60 |

The fertility rates of mothers show that the lower fertility of the Catholic elite is largely explainable in terms of childlessness, although this does not account for differences between elite and non-elite. When we examine the group of childless Catholic elite, we find that although they are largely unmarried (87 per cent) they have had an average of 5.2 years of exposure to the risk of conception, all want to have a child and none has practiced birth control. We must conclude, therefore, that the rate of sterility is unusually high in this group, but why this is so is beyond the scope of our investigation. In any event, it would seem that part of the explanation for non-use of birth control among the Catholic elite is infertility rather than Catholicism.

An independent datum which confirms our impression that Catholics are not especially affected by religious teaching on birth control is provided by the records of the Jamaican Family Planning Clinic. Located in Kingston, the clinic has had over 7,000 patients in its eighteen years of existence. Most of these came from the metropolitan area, although recently over a third have been coming from the country. Eighteen per cent of the clinic's patients have been Roman Catholic. In the population as a whole, only 7 per cent are Catholic, and in the metropolitan area 19 per cent.

**Conclusions**

Although we have attempted several different ways of classifying religious groups, we have been unable to detect among Roman Catholic women any special conservatism as regards family planning, whether this be in the area of knowledge, attitudes or actual behavior. Indeed, largely due to their superior education and urban residence they tend to be more liberal than non-Catholics in general.

When similar findings were established in Puerto Rico, we speculated that the minority status of Protestants might make them especially fervid and conservative in belief, and the majority status of Catholics make them lax as regards church teaching. The fact that we find precisely the same pattern in Jamaica where the majority-minority positions of Catholics and Protestants are reversed throws, considerable doubt on this hypothesis and suggests that among lower class populations in some underdeveloped areas, the influence of Catholic teaching in the sphere of family planning has been negligible. Indeed, one wonders whether the Church's teachings on this subject may not be boomeranging by spreading knowledge of family planning among the uneducated classes.

Some critics have suggested that our samples are too small to make firm generalizations about comparative religious behavior in Puerto Rico and Jamaica; and that the survey interview method has a number of deficiencies which cast doubt on findings in this area. The small numbers do necessitate caution about generalization. However, the large number of cases of actual behavior reported by the Jamaica Family Planning Clinic appear to substantiate our findings.

# ADDRESS OF HIS HOLINESS POPE PIUS XII*

## Moral Questions of Genetics of the Blood

*An address delivered in French to blood specialists attending the seventh congress of the International Society of Blood Transfusion in Rome by His Holiness Pope Pius XII on September 5, 1958. This address is of significance for eugenics because couples with problems in heredity are advised to obtain information from such counseling services as the Dight Institute for Human Genetics. It is pointed out that the decision to have children is left up to the parents by the Dight Institute, which is not a clinic to repress fecundity.*

The International Congress for Blood Transfusion, organized by the international association of the same name, gives Us the pleasure of receiving you, Gentlemen, and learning of your activities.

Following your meeting, the Seventh International Congress of Hematology will be held. We are aware of the increasing importance of problems concerning blood in contemporary society and the practical application of the conclusions and of the resolutions which you will adopt. We are also happy to show you Our esteem and to welcome you cordially.

In addition to the seriousness of the matters under consideration which you have called to Our attention, you know that the Church, whenever she can by her presence or by timely intervention either to do great good or avoid great harm, does not remain indifferent to the problems which concern the individual and the social, temporal and eternal aspects of human destiny.

Hematology, the science of blood and of its diseases, involves biology, physiology and medicine to the greatest degree. Blood is, in fact, in a certain sense, the center where the exchanges of organic life take place. It carries oxygen and the elements which assure the nourishment of all the cells. At the same time, it insures the elimination of waste by the cells.

It was long considered that blood was intimately bound up with life itself which seemed to pour out with it through open wounds. Even today the expression "to give his blood" means a sacrifice that a man has made of his life for a cause which he believes worthy of this supreme offering and which, at times, is identified with the highest ideals that humanity can offer.

Since the participants of the coming hematological congress have asked Us to speak of certain moral questions which come under the domain of genetics of the blood, We intend to take up now the general aspects of these problems and thus prepare the answer that We shall give them. Therefore, We shall discuss here some of the biological aspects of the genetics of the blood and the problems they give rise to.

### I. CERTAIN MEDICAL-BIOLOGICAL ASPECTS OF THE GENETICS OF BLOOD

We have already had the opportunity to speak of the mechanism of heredity in Our address of September 7, 1953, to the first International Symposium of Medical Genetics (Discourses and Radio Messages, Vol. 15, p. 253 ff.) and to announce then the important principles applicable to

*English translation supplied by the NCWC News Service.

scientific data of genetics in its relation to moral and religious questions. At any rate, in order to clarify Our subsequent development, We must again touch on some recent discoveries of which you have kindly informed Us.

It is generally known today that the red blood corpuscles have their own nature and that the human race is divided into four blood groups (A-B-O-AB). If "antigene" means the ability to produce in an organism the formation of substances called "antibodies" which may unite with antigenes and bring on first the agglutination and later the destruction of the red corpuscles, one can explain the existence of the four groups in the following manner:

Groups A and B each possess an antigene of their own but not a corresponding antibody but (at the same time) each possesses the antibody of the antigene of the other group. The AB group possesses two antigenes but no antibody. The O group does not possess any antigene but it does possess the two antibodies.

During the past decades the discovery of other systems has introduced a considerable complexity in the exact determination of the types of human blood. But what interests Us mostly is the discovery of the "Rhesus" factor which accounts for the pathogenesis of the hemolytic illness of the newly born and which, until now, has been of unknown origin.

A mother who has "RH negative" will produce antibodies for "RH" positive globules and if the child she carries is "RH positive," she will harm it.

Since blood groups are inherited according to the mechanism of heredity following essentially the Mendelian law, it is evident that to have a "RH positive" child, the mother must have an "RH positive" husband. If he is the son of parents one of which is "RH positive" and the other of which is "RH negative," there will be a 50 percent probability of having "RH positive" children. But if the parents are both "RH positive," all the children will also be "RH positive." When an "RH negative" woman marries an "RH positive" man, she finds herself in what is called the 'RH situation," and in potential danger of having sickly children.

Side by side with the dangerous heredity, one can also consider the positive aspects of this heredity. Medical science is mainly interested in the harmful consequences and it is understandable that these are most strongly stressed.

Actually, examples are not lacking of very gifted families in which remarkable physical and psychological qualities have been transmitted from one generation to another.

May We be allowed to point out once again a particular case because of the importance it has in the Mediterranean area. It refers to two illnesses that are viewed separately from the clinical standpoint but are characterized by similar alterations of the blood system.

The first affects certain areas of the Italian population, all of the Greek population and all areas of the Mediterranean basin where Phoenician colonization left its mark.

A child is born apparently normal, but the doctor already notes in him signs of illness which more or less rapidly will lead to death, usually before his 10th year. His development will be notably retarded, his color pale, and he will have a protruding abdomen which denotes an enormous enlargement of the spleen which often almost completely fills the abdominal cavity. The most careful therapy can only prolong a life of suffering and discomfort, and in spite of innumerable blood transfusions which represent a very heavy expense for the family, the fatal outcome is inevitable.

At the time that Cooley and Lee succeeded in diagnosing exactly what this sickness was in the descendants of Italians who had emigrated to the United States, Rietti, Greppi and Micheli of Italy described a sickness that was apparently entirely dif-

ferent. Among adults leading an apparently normal life symptoms showed up which were found to be shortening the life span of the red blood corpuscles. This also brought about morphological changes of a congenital nature, affecting the intimate form and structure of the corpuscles as well as the hemoglobin they contained.

These clinical forms of the sickness are today considered varieties of a group called "Mediterranean hematological disorders." American, Italian and Greek researchers have demonstrated that the changes in the serious and mortal sickness of children, as Cooley has described it, resembled those of the sickness of Rietti, Greppi and Micheli and forms similar to it. Therefore, they came to the conclusion that the sick children had been begotten by two carriers of the Mediterranean hematological disease.

The thing that must be emphasized here is that individuals who believe themselves to be perfectly healthy can, by their union, bring about predictable family tragedy.

## II. PROBLEMS OF THE GENETICS OF THE BLOOD

The painful situation which We have described and other analogous ones met with in the domain of the genetics of the blood deserve special consideration in order to resolve the particularly serious problems of the psychic and moral order.

We shall speak of some of them on the basis of the information you have supplied Us as well as of the remedies that have been attempted, at the same time considering the moral implications they carry.

We must emphasize first of all the necessity of furnishing the public with the indispensable information about blood and its heredity so that individuals and families may be on the watch for terrible accidents. With this aim, information and consulting services can be organized along the lines of the American "Dight Institute," which can be consulted confidentially by engaged and married couples regarding questions of heredity so as to better insure the happiness and security of their union. These services would not only give information but would help interested parties to apply the remedies which might help.

In a work that We have been assured is authoritative on the subject (Sheldon C. Reed, "Counseling in Medical Genetics"), We have read that the principal function of consultation is to explain to interested parties the problems of genetics as found in their families (*Ibid.* III, page 12). In almost every home, it would seem, one meets difficult situations concerning the heredity of one or several members of a family.

It may even come about that the husband and the wife accuse each other of a malfunction which has appeared in their child. Often the specialist who has been consulted can successfully intervene to lessen the difficulty.

Warned of the danger and of its extent, the parents will then come to a decision that is either "eugenic" or "dysgenic," in regard to the hereditary characteristics involved. If they decide not to have children their decision is "eugenic," that is to say that they will not propagate the defective genes by begetting either sick children or normal carriers.

If, as usually happens, the probabilities of begetting a child who is a carrier of the defect are less than they feared, it may be that they decide to have other children. This decision is "dysgenic" because they will propagate the defective strain instead of arresting its diffusion.

Finally, the effect of the genetic consultation is to encourage parents to have more children than they would have had without it, since the probabilities of having an unfortunate result are slighter than they had first thought.

If the consultation may appear "dysgenic" in regard to abnormal genesis, it must be considered that people who are sufficiently worried about the future to ask for advice have a high conception of their

duties as parents. From the moral standpoint it could be wished that these instances were more numerous.

The Dight Institute is often asked if there are relationships between consultation and religious duties (*Ibid.* pages 15-16). In reality, genetic consultation is apart from religious principles.

Consultation does not answer parents who ask whether they should have more children and leaves the responsibility of the decision to the parents. Therefore, the Dight Institute is not a clinic to repress fecundity. It does not furnish information on how to "plan" families, for that question is not within the scope of their objectives.

The book from which We take these remarks emphasizes with force and precision the importance of the work that still remains to be accomplished in this field. "Death," it says, "is the price of ignorance of the genetics of the blood groups."

Fortunately, medical science has at its disposal at present enough knowledge to help men to fulfill with greater safety the desire, so intimate and so powerful among a good number of them, to have a happy family of healthy children.

If a couple is sterile, the doctor will try to induce fecundity. He will put them on their guard against dangers they do not suspect. He will help them to beget normal and well-built children.

Better informed on the problems which genetics bring up and on the seriousness of certain hereditary illnesses, men have today, more than in the past, the duty to keep in mind the conquests of medicine and to avoid for themselves and for others many physical and moral complications.

They must watch out for everything which could cause lasting damage to their progeny and which could involve it in a series of interminable misfortunes.

Let Us recall that, in regard to this topic, blood relationships among people, both in the family and in the community, impose certain obligations. Although the formal elements of every human community are of a psychological and moral order, the progeny constitute the material basis which must be respected and preserved from harm.

What We could say about heredity could be applied in a wide sense to the communities which make up the human race. But the danger here comes more from an exaggerated insistence on the sense and value of the racial factor.

It is only too well known, alas, to what excesses pride of race and racial hate can lead. The Church has always been energetically opposed to attempts of genocide or practices arising from what is called the "color bar." She also disapproves of all genetic experiments which cheapen the spiritual nature of man and treats him as another type of the animal species. .

We wish you, Gentlemen, to continue successfully your work so useful to the human community. A more lively awareness of the efficacious help which you bring to so many sick people will be added to the practical teachings of this congress. From this conviction you will draw more ardor for carrying out your daily tasks and the certainty of having deserved the respect and gratitude of those who owe their life and health to you.

In pledge of the Divine favors that We call down on you, We grant to you, your families and to all those dear to you, Our Apostolic Blessing.

# BOOK REVIEWS

THE CHANGING POPULATION OF THE UNITED STATES: Conrad Taeuber and Irene B. Taeuber. A Volume in the Census Monograph Series. John Wiley and Sons, Inc., New York; Chapman and Hall, Limited, London; for the Social Science Research Council in cooperation with the U. S. Department of Commerce, Bureau of the Census; 1958; xi, 357 pp.; $7.75.

This volume in the Census Monograph Series fills a gap of long standing in the American demographic bookshelf. Not since the publication of *Population Trends in the United States,* by Warren S. Thompson and P. K. Whelpton, in 1933 have we had a comprehensive systematic presentation of facts and findings about the population of this country. Much has happened in the interim, both in the way of improved information and in the way of altered trends. Dr. Conrad Taeuber, Assistant Director of the U. S. Bureau of the Census, and Dr. Irene B. Taeuber, of the Office of Population Research and *Population Index,* both prominent scholars in the field, have assembled the pertinent materials and fashioned them into a compact and timely account of the nation's population history and current status.

It was no easy task. Perhaps the reason that it was not attempted sooner is the sheer mass of documentation, factual, analytical and theoretical, which has accumulated over the years in the many special lines of inquiry and before which even the stoutest demographic spirit might be expected to quail. As it is, the authors have winnowed, distilled and compressed to the point where one occasionally wonders why the binding does not fly off in response to the great pressure from within.

The authors being experts, the distillation is eminently successful. There is no wasting of words; one must read with close attention. The results of whole areas of research, still damp with the sweat of many a demographic brow, may be presented in a paragraph or two of lean prose. This is as it should be, is in fact necessary if we are to have a view of the woods unimpeded by the trees. But the economy of the authors in matters of elaboration, definition and style has not led them into false simplification or easy generalization. So far as this reviewer is able to judge, the proper qualifications are all there. Matters open to question are left open to question. New insights into old problems are offered. Definitions necessary for understanding are given, albeit briefly and often in literary asides such as footnotes, parenthetical inserts and carefully worded table-headings. Much detail is omitted, of course, but sources and relevant works are faithfully cited.

The presentation is made under four principal headings: growth, characteristics, natural increase and conclusions. (The last treats relations among the major demographic variables and examines the possibilities of future development.) The seven chapters of Part I describe the growth in numbers and area, the changes in age and sex composition, the magnitude and effects of immigration, and the patterns and products of internal migration with particular attention to the growth of urban places and the development of metropolitan agglomerations. Part II resumes trends and analyzes the current position with respect to marital status, households and families, education, and economic activity. A chapter on income, using the data from the Census of 1950, is also included. Part III con-

sists of a chapter on fertility and a chapter on mortality. Of particular interest in the first of these is the summary of the evidence regarding the narrowing of fertility differentials between status groups. This chapter includes a short account of the extremely interesting findings concerning the long-standing importance of the decline in rural fertility as a factor in the fall of general fertility in the United States. (The detailed report of these findings is appearing in another volume of the Census Monograph Series: Wilson H. Grabill, Clyde V. Kiser and P. K. Whelpton, *The Fertility of American Women.*)

No separate consideration is given to the racial or color composition of the population, but color differentials, as well as variations by other characteristics, are analyzed under each specific topic. Repetition is avoided by judicious selection of cross-classifications and by forward and backward references to relevant matter in other chapters.

The next but last chapter, "Interrelations in Development," analyzes the interplay of fertility, mortality and migration in the context of American industrial development and urban growth. The final chapter, "The Prospects," deals with the sensitive area of population projection, giving attention to possible trends to 1975 in total numbers, families, population of school ages, the labor force, military manpower, the aged, and child dependents. This chapter handles its subject with due caution, is indeed a masterpiece of dead-pan *reportage.*

Throughout, the basic point of reference is the array of censuses and vital statistics of the United States, particular attention being given, of course, to the results of the Census of 1950 along with important supplementary material from postcensal surveys as recent as 1955. The study benefits, in addition, from the gratifying progress that the science of demography has made in the last decade or so. This is especially apparent in the treatment of postwar movements in the birth rate.

The text is liberally interlarded with first-rate maps, tables and diagrams. Especially handsome, and immediately informative, is the bar diagram on page 254, which tells its part of the history of American fertility with dramatic simplicity. A valuable bibliography of relevant Census and NOVS publications is given as an appendix. A subject index is provided, but not a name index.

Since it is part of a reviewer's duty to take note of presumed imperfections, it should be mentioned that there are moments when the text is almost cryptic in its brevity. Also, it would be helpful to the reader if the standard geographic divisions and regions of the United States were identified in a table or map near the beginning of the book. Table 2 (p. 14) lists the States in their divisional order, but the divisional names have been omitted.

This book should become a standard work in American demography. Its rigorous adherence to statistical facts and tested knowledge, its scrupulous avoidance of evaluative interpretation or moralizing, give it a good chance for survival and render it unlikely to prove a source of embarrassment to its authors at some time in the future. It will make a useful textbook for courses in population; it provides an excellent base for further excursions into the many special fields of demography. In the main, its language and content are not beyond the grasp of the determined layman.

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VARIABLES RELATED TO HUMAN BREAST CANCER: Elving Anderson, Harold J. GOODMAN and SHELDON C. REED. University of Minnesota Press, Minneapolis, 1958, 172 pp., 41 text, tables, 53 appendix tables, 7 figures. $4.00.

The purpose of this study was to determine whether there is a significant excess of breast cancer in relatives of women se-

lected because they have breast cancer (designated as propositae) and whether any familial tendency to cancer (if such exists) is site specific, or whether it is for cancer in general. The book opens with a review of other similar studies and outlines the method of approach used by the authors.

As is usual in such studies, a proper selection of propositae and controls is the starting point on which the research rests. They selected all the propositae from the Tumor Clinic of the University of Minnesota Hospital and selected the sibs (brothers and sisters) of the propositae's husbands as controls. To explain in detail the methods which the authors used to determine whether their propositae and controls were an unbiased sample would be to reproduce the book itself. Factors such as age of onset, marital status, fertility, residence, whether urban, rural non-farm or rural farm, nationality, etc., were considered, and the propositae and controls were compared. The information was secured by questionnaires sent out to relatives of the two groups, by personal interviews, and by use of death records and hospital reports.

The methods by which the data were analyzed are discussed in great detail; (1) proportional death rates (the percentage of deaths in individual age groups that are attributable to breast cancer) which, of course, can use only those cancers in deceased persons; (2) use of mortality and morbidity rates on all relatives living and dead; (3) a direct age-adjusted comparison between cancer and control groups; (4) a comparison of the morbid risks for cancer in the two groups; and (5) an application of the sequential analysis method to the data on sisters only.

By use of the first method, the only significant excess of breast cancers was found in the sisters of the breast cancer propositae (23 observed to 12.4 expected). Because living sisters with breast cancer could not be counted by this method, the 25 living sisters of breast cancer propositae and the 9 living sisters of the control propositae who had breast cancer could not be included.

The second method made use of the morbidity rates for breast cancer for Iowa for 1950, which are the numbers of newly diagnosed breast cancer in Iowa in the year 1950, in specified age groups. This permitted use of living and dead relatives. By this method the mothers of breast cancer control propositae had only 9 breast cancers when 28.4 were expected. On the other hand the mothers in the control group had only 2 when 23.3 were expected, so that by this method although both groups of mothers showed a marked deficit of breast cancer, the deficit was 3.58 times as great in the control mothers as in the cancer group mothers. Sisters in the cancer group had more breast cancers than expected, but not significantly more, and sisters in the control group had less than expected but not significantly less.

The details on the results of the other three methods on the same data will be omitted and the general conclusions of the study given. With the exception of the sequential analysis method, all analyses showed a significant excess at the 0.05 level of breast cancers among sisters of breast cancer propositae as compared with the sisters in the control. The mothers showed an excess of breast cancers, only if the cases reported as breast cancer but not certified by officials records were used.

To obtain information on *daughters* of breast cancer propositae, a second group whose breast cancers were diagnosed about 25 years ago were chosen. This allowed a span of a generation during which their daughters might develop breast cancer. As a control for this group, the wives of the sons of the propositae were chosen. The breast cancer rate is much higher in single women than in married, so the single daughters were excluded from the group,

and only married daughters were compared with sons' wives. They showed three times as much breast cancer as the controls.

Some of the conclusions are as follows: Breast cancer probably includes a group of conditions heterogeneous in etiology, which may ultimately be separable into groups based upon pathological or biochemical differences, in which case genetic analyses will have to be made on each type. Sisters of breast cancer propositae had an excess of breast cancer as compared with the control group; the excess was not large enough to permit a conclusion by itself, but in conjunction with other investigations the consistency of the result indicates that it is a real excess even though small. It is very likely that genetic factors are involved in the etiology of breast cancer, but they are either so common in the population or depend so much upon environmental factors for expression that it is difficult to demonstrate their effect. It has been adequately shown that relatives of breast cancer patients do not have an excess of cancers at other sites.

Comment: This study, like all such researches, including that of the reviewer still unpublished, will prove of interest in its entirety mainly to the limited number of workers in the immediate field, although the conclusions will be of general interest. The authors make one statement (p. 116) which appears to be unfortunate, "After the research projects now in progress have been completed it would seem that additional, more extensive projects of the present type would add little to the understanding of possible genetic factors in breast cancer." It is true that they add that with the information compiled in their study and other recent researches, it should be possible to devise new approaches to the general problem. The first quotation would suggest that the ultimate has been reached in the way of selecting propositae and controls by the various researches into this subject, a viewpoint with which the reviewer is not in agreement. The very fact that different conclusions have been reached on different populations is in itself important.

The authors state that the genetic factors depend so much upon environmental factors for expression that it is difficult to demonstrate their effect. Yet they have shown the marked similarity in those variables they investigated between the sisters of the propositae and the sisters of the controls, producing as far as can be determined a similarity in environmental conditions, so that any differences in frequency might be legitimately interpreted as being caused by genetic factors. The excess in sisters was significant at the 5 per cent level. To the reviewer, these statements do not agree with the conclusion that it is difficult to demonstrate the effect of genetic factors. If the authors mean that it is difficult to demonstrate the *number* of genetic factors involved or the *mode of inheritance*, the reviewer is in complete agreement.

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THE POPULATION AHEAD, Edited by Roy G. Francis. University of Minnesota Press, Minneapolis, 1958, x, 160 pp.

This small volume has eight papers, preceded by a witty introduction, and followed by rather diffuse comments. These are the proceedings of a symposium at the University of Minnesota in 1957. The papers form a remarkable series. Considered individually they are, in most cases, succinct and lucid statements of knowledge and issues in various fields of scientific inquiry relevant to the interpretation of population trends. As a series, these independent papers have a surprising coherence.

The first paper is a concise account by P. K. Whelpton of population trends by world regions, with an analysis of the recent movement of births in the United States. The world's population seems, in

short perspective, to be increasing at a merely moderate rate, 1.5 per cent per year; but the cumulative force of this increase is explosive. If the present rate had prevailed through the Christian era, there would now be more than a million persons per square foot of land surface. And, due to progress in health in the impoverished two-thirds of the world's population, the tempo of this explosion is still rising.

Sufficient nutrients can be drawn from the earth's resources to sustain this increasing population, at least within the visible future. The authoritative statements by Ancel Keys, physiologist, and Jan Broeck, geographer, are conclusive on this point. Estimates cited by Edward Deevy, a biologist, seem at first sight contradictory. The estimated production of energy by the plants of the lands and the seas is $2 \times 10^{17}$ per year. About 10 per cent of the plant energy consumed by herbivores is translated into their vital energy, and about 10 per cent of this energy is recovered from carnivores. The energy requirement of the world's human population today is about $1.6 \times 10^{15}$ per year. So if men were completely carnivorous, we would, it seems, already require most of the world's biotic potential for our sustenance; if we were purely vegetarian, the apparent limit would be about twelve times our present number —*i.e.*, a century and a half away at the present rate of increase. But some plants obtain a higher proportion of their total energy from sunlight than other plants. Water hyacinth and chollera can produce many times as much energy per square meter as the average food crops of the world today. Moreover, new possibilities of synthetic food production are being developed. Food is essentially energy; and potential resources of solar and atomic energy are practically inexhaustible.

Broeck suggests that mineral resources may enforce more stringent limits on population growth than food resources; but Harberger, an economist, points to the possibilities of substituting more abundant minerals for those likely to be exhausted and to the increased productivity of present resources with new technologies. The technological explosion is progressing even more rapidly than the demographic explosion. Even if living space on the earth is exhausted, after man has destroyed most other forms of life, lodging may be found in hermetically sealed chambers on artificial satellites in outer space. The prospect appears grim to minds made tender by poetry or religion. The participants in the seminar seem generally to have been tender-minded in this respect. But if men are willing to sacrifice their traditional values, there seems to me no fixed limit to the possible increase of their numbers.

If Malthus is dead, as suggested in the previous paragraph, so too is the concept of an absolute population "optimum" under any given conditions. This concept was relegated, by Frederick Osborn, to the limbo of vacant words. Osborn then defines the most critical issues of population policy as those relating to (1) optimum rates of population changes under given conditions and (2) changes in the characteristics of individuals through successive generations. With respect to the second issue, he deals mainly with social characteristics in a statement notable for its profound sense of civic responsibility, common sense, and respect for sociological principles. Questions relating to "the genetic future of man," to which Osborn referred only briefly, were treated explicitly by Karl Sax. His statement seems to imply that lethal selection is no longer operative. Actually many individuals with hereditary defects still die prematurely, in spite of the energy and skill of the medical profession to the contrary. But, of course, the force of lethal selection has been curtailed; its present role was presumably neglected merely in the interest of brevity. Sax's paper includes a highly informative account of the influence of radi-

ation on genetic characteristics, "Deleterious genes inherited from our ancestors cannot be eliminated, but their frequency could be reduced. . . . If, however, the mutation rate is substantially increased any progress made by eugenic controls might be offset by new deleterious mutations." There seemed to be a general consensus among the participants concerning the importance of these neglected social and genetic aspects of demography.

There was also a general consensus that the acceleration of natural increase in the modern world, especially in relatively under-developed countries, tends to perpetuate malnutrition, which in turn lowers productivity, and to hamper capital formation and the advancement of education which are essential to progressive economic and social development. The excess of current rates of increase above any rational optima results from the perpetuation of primitive reproductivity while the brutish force of disease is diminished. Many of the participants seemed confident that man's spiritual resources have sufficient vitality to meet this challenge. But Robert Spencer, who as an anthropologist has the keenest appreciation of the diversity and persistence of traditional cultures, seemed less optimistic.

A layman who asks, "What are population problems?" will find an answer in this readable little book. It will also significantly increase the knowledge of any scientist who peruses it. The reviewer extends his congratulations to those responsible for the organization of this symposium.

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ABORTION IN THE UNITED STATES: Mary Calderone, M. D. (Editor). Hoeber-Harper, New York, 1958, 224 pp. $5.50.

One of the main problems in this and any other society, from every point of view, is the problem of abortion. This report of a conference on abortion in the United States, attended by outstanding physicians, demographers, legal authorities and Public Health directors, could not help but be an outstanding and provocative document. Furthermore, Dr. Mary Calderone and her staff are to be heartily congratulated for so successfully coordinating what must have been a massive amount of conversational round-table data comprising the formal and informal statements of the participators, and having the result emerge in a coordinated reasonably sequential account of the deliberations of the committee. Almost but by no means all of the abortion problems, attitudes, and practices both legal and illegal in the Scandinavian countries and the United States are considered in this monograph of 184 pages accompanied by a very useful appendix.

Definitive and conclusive recommendations or solutions to the problems of both legal and illegal abortion naturally could not be solved in a two-day conference however enlightened and capable the participators might have been. Therefore, the main value of this report is its attempt to pull the ostrich head of the body politic out of the sand—to explain, reveal, and as forcefully as possible emphasize a "disease in our society" about which people are either unaware or entirely too casual.

There are many impressive comments in this book which serve to augment the process of thought of many physicians who have served on Therapeutic Abortion Committees, and although many of the problems facing the members of such a committee are still insoluble, a book such as this should be required reading for every such committee member.

Possibly one of the points of view which had not really occurred to many of us was the one repeatedly expressed by various

members of this conference—that the desire of a woman for abortion, be it either illegal or therapeutic, is a symptom, not a a disease in itself, and the fulfillment of a patient's desire to be aborted may be far from the solution of the social, economic, marital or physical disease from which she is suffering. Therefore, as Dr. Galdston says, "I do rather think that initially it is our social and scientic obligation to search for ways and means whereby the need for abortion is reduced to the absolute minimum, and then to help legalize and facilitate abortion for that requisite minimum." Following this train of thought to its logical conclusion, the conference suggests "consultation centers for women seeking abortion, modeled after the Scandinavian centers now in existence," and this is certainly one of the more powerfully positive recommendations of the conference.

It is easy enough for Ashley Montagu to state that "between half a million and a million women" are "abandoned" by our society because we refuse to abort them in their hour of need and misery. It may be true that this contributes an "increase to suffering and constitutes a wholly unnecessary loss to society," but he fails to take into account the fact that an abortion of any kind is the taking of a life and to deny the fetus the right to future life is a decision not to be entered into lightly.

Thus the problem of abortion has its philosophical aspects also, and it is regrettable that, at such a significant conference as this, the philosophical-religious point of view did not have a protagonist. We who are more liberal, or possibly more casual, may consider the Roman Catholic attitude toward abortion to be a rigid and fixed one immune to other opinion, but this is no reason why this point of view should not be considered with the others. Possibly an opportunity was given by the sponsors of the conference to present this point of view but was refused. However, there are many other philosophical and religious dogmata involved in this problem, a consideration of which might well have made the conference more fruitful and persuasive.

The eugenic implications of the abortion problem are, of course, enormous. However, Dr. Douglas states that he has been informed by "good sources that if we completely segregated all the mentally retarded in this country or if they were all sterilized or aborted, the greatest reduction in mental defectives that could be anticipated in this field would be a rather insignificant fifteen per cent."

Law, in a way, is the servant of custom, and its changes inevitably follow behind the mores of a society. As was amply demonstrated by the Eighteenth Amendment, it is possible to legislate for too long against the will of the people. The probability is that as a result of enlightening conferences such as the one herein reported, legal modifications will occur in abortion laws throughout the country, very probably liberalizing genetic, socio-economic, and psychiatric indications, but this will never be done without the constant prodding of thoughtful and concerned individuals such as the members of this conference. This book deserves to be read by everyone interested in the basic problems of our society—and that means practically anybody with a social conscience.

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Differential Psychology: Anne Anastasi. The Macmillan Company, New York, 1958 (3rd Edition), 664 pp + xii.

This is the third revision of a book which, on its first appearance in 1937, rapidly established itself as one of the major texts in its field. This revision, incorporating the most recent work on the topic, shows the same characteristics as distin-

guished the earlier editions. The major studies in the area are reviewed and their relevance evaluated; the discussion is at times brief, but always acute; and the sources drawn upon are very extensive indeed.

In the study of individual differences it is inevitable that the science of genetics should play a large part, and Dr. Anastasi devotes a considerable proportion of her discussion to the genetic aspects. Of the introductory chapters, one (a good one) is devoted to a review of the measurement of individual differences, and two to the assessment of nature-nurture studies; and this latter topic is recurrent throughout the book. In the absence of any really adequate evidence on the genetics of human psychological traits, it is almost a matter of taste on which side of the heredity-environment fence one takes one's position. To this reviewer, Dr. Anastasi shows a predilection for the environmental side. The discussions of intelligence, for instance, tend to stress most those studies which demonstrate the cultural and environmental determinants of IQ, without carrying to its logical conclusion the proposition that as intelligence can only be assessed in terms of observed performance, any improvement in performance, whether by education or practice, should, by definition, raise the known level of intelligence. A somewhat similar reluctance appears in the discussions on racial and cultural differences in intelligence. Dr Anastasi is willing to admit qualitative differences between individuals, but less willing to admit such differences between groups. Cultural and educational differences are not entirely things that are given or withheld, they can be made; and to deprive a person of high intelligence of the cultural and educational skills through which alone this intelligence can express itself is as misleading as to assess another person in terms of a culture more complex and extensive than his own. It is not that Dr. Anastasi is unaware of these arguments; it is a matter of emphasis in reviewing them.

Such differences of emphasis do not detract from one's appreciation of Dr. Anastasi's scholarly and critical approach to a complex area of study. The book does not pretend to be a popular presentation; it is clear but not simple; and as a compact and comprehensive survey of individual differences it has yet to be surpassed.

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FIVE YEARS OF FAMILY PLANNING IN THE COUNTRYSIDE: Baljit Singh. J. K. Institute Monograph No. 6, J. K. Institute of Sociology & Human Relations, Lucknow University. 1958. 118 pp.

India is the scene of this well-planned and efficiently executed investigation. The "countryside" comprises 26 villages connected by road and rail with Lucknow and Sittapur. The villages contained some 1,600 households in which lived 8,660 people. These included some 1,900 married females, of whom 1,453 (76 per cent) were comprised in the sample. Nearly three-quarters of the husbands and nearly all of the women were illiterate. Twelve per cent were Muslims, the rest being Hindus.

The three main objectives of a project which took five years (1952-1957), were (1) the collection of reliable data as to rural fertility; (2) the study of the attitudes of country people toward family planning and their responses to efforts to teach them four practicable methods; and (3) the ascertainment of which methods of family planning were most *acceptable* to village people. (Little is said about the *reliability* of the four methods in so far as these were used.) The couples concerned had had no previous experience of birth control.

The sample's "pre-experiment fertility pattern" is described in some detail. Marriage was universal for all women but remarriage after the death of, or separation

from, the husband was rare; sterility was low (one per cent only of women over 45 were childless); the average age at marriage was 13.8 years and at first maternity 17.4 years; by the age of 45, the average mother had borne from six to seven children, but the number varied according to the caste (upper caste Hindus were more fertile than intermediate and lower castes) and occupation (artisan and service classes were more fertile than cultivators and laborers). Other interesting differences in fertility are described.

The rhythm method, to which the 1,453 women were first introduced by the use of colored beads, proved the least successful; the main difficulty was inability to count, and only 4.2 per cent of the women used it. Slightly more acceptable was the oil plug method (a cotton pad dipped in oil). The sponge method was better, being regularly or occasionally adopted by 8 per cent of women. The most successful of the four methods was the foam tablet, the distribution of which was begun rather late in the experiment (June 1955): about one in six of the women took to it; and if women wanting more children and those indifferent to family planning (together amounting to 50 per cent of the total) are excluded, one woman in three used these tablets.

Professor Singh points out that, in his 26 villages, four is the optimum number of wanted children. "The fourth surviving child seems to focus attention sharply on family limitation." But three children are enough to restrict, in the manner desired by planners, the rate of population growth. Hence there exists at present a disparity between what are called "individual and social optima." Interesting differences were disclosed in the attitude towards family planning: these relate to the parity of mothers, to the ages of husband and wife, to occupation, literacy, and religion (relatively more Muslims than Hindus adopted birth control). Another factor is the distance of the couple's home from the centre providing the contraceptive services. Stress is laid on the importance of a good follow-up system.

Perhaps the most interesting finding of this inquiry relates to the effects of child mortality. The more numerous the children, the higher the ratio of deaths. As long as women continue to desire, and plan for, four surviving children, the spread of family planning will diminish but little the rate of the population's growth. In the author's words: "Even a widespread adoption of the practice of family planning, unless it goes sufficiently deep and becomes effective in restricting average number of births to three per mother, will not materially lower the current rate of population growth." In other words, the aim of reducing the rate of population growth will not be attained, however widely birth control is practiced, unless individuals scale down the ideal size of their families from four to three.

Fortunately, however, rural people are not immune to education in this rapidly changing world; re-orientations are possible; neither urban nor rural patterns are immutable.

The author is in no doubt that a need for family planning exists in his villages; but available methods are not perfect. Simpler methods, in particular an oral method, would be welcomed.

Professor Singh is to be congratulated on the execution of a well-designed project and on a concise report.

C. P. Blacker
The Eugenics Society

Population: An International Dilemma. A Summary of the Proceedings of the Conference on Population Problems—1956-1957. Frederick Osborn. New York, Population Council, 1958. Pp. ix + 97. $2.00.

As in American social science generally, so also in population analysis, the pub-

lished work of the best men in the field tends to be addressed exclusively to their professional peers. Popularization, since it is defined as hack work, is typically done by hacks. With certain exceptions (the most notable of which is the excellent periodical *Population Bulletin*), the articles and books written to satisfy the broad, rather than the deep, curiosity about population phenomena are second-rate at best. The very notion that a Thomas Henry Huxley is a necessary supplement to every Charles Darwin is foreign to scholarly and academic circles.

Against this background, this little book acquires a special significance, both in itself and possibly as a precedent. Over a period of a year and a half, a committee set up by the Population Council sponsored a series of meetings "in the hope that it might be possible to develop an understanding of how best to approach the problems of world population growth." Judging from the list of the participants and the titles of their papers, these discussions included at the highest professional level all of the basic issues confronting population analysts. To abridge these papers not only into a short, simply written book but into a coherent narrative was a remarkable achievement. Too bad that it was not published in a paperback edition to be sold for a quarter.

The content of the book can be divided into three parts: a short introductory statemen of the demographic transition, which emphasizes the historical uniqueness of current population growth; an analysis of the world's major cultural practices and moral beliefs affecting fertility; and a discussion of possible policies both in underdeveloped areas and in industrialized countries. The excellence of the book is indicated by the fact that, though it is presumably aimed mainly at a general audience, demographers will find it of interest. The discussion of Roman Catholic morality, for example, assumes the standard sharp contrast with Protestantism and stresses rather the similarities between the two. Or, as another provocative point: if it should become necessary in the United States to discourage fertility, such a population policy would come into conflict with many of the country's democratic institutions and, even more, its social-welfare legislation. What politician would dare suggest—to cite only a few instances—that parents should pay for the schooling of their children, that the income-tax exemption for dependent minors should be eliminated, that married men and fathers be drafted on the same basis as others?

In the world today one of the most important moral systems affecting family life and fertility levels is Communist ideology. Its significance is no less than any of the world religions, and with respect to Asia probably greater. This book does not give this difficult and polemical subject the attention it warrants; and the few passing references to Communism—for example, that the mainland Chinese government has "placed itself on the side of those who seek to improve the quality of family life"—are not enlightening.

Such lapses, of which this is the most important, must be judged against the book's general excellence. In less than one hundred pages, the problems posed by the growth of the world's population are stated directly and forcefully, but without passing over the complexity of either the causative factors or possible ameliorative policies. In summarizing what we know, the book also points out how little that is and sometimes why: for instance, "The total amount of money being spent on research on reproduction is very small compared to the need, a fraction of that spent on any one of the major diseases."

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# *Periodical Reviews*

## GENETICS

**The monogenic theory of schizophrenia.** E. Slater. *Acta Genetica et Statistica Medica* **8** (1958), pp. 50-56.

The author examines critically the hypothesis that schizophrenia is due to a single dominant gene that is completely penetrant in the homozygous condition but which shows reduced manifestation or penetrance in the heterozygous condition. By developing certain mathematical models, he demonstrates that for a given frequency of schizophrenia in the population, the frequency of schizophrenia in various types of relations of schizophrenics would vary in a complex way with different gene frequencies and heterozygote manifestation rates. For a population frequency value of 0.008, he showed that published data are compatible with a gene frequency of 0.015 and a manifestation rate in the heterozygote of about 0.26. Using these values, the conclusion is reached that 97 per cent of all schizophrenics are heterozygous for the gene, while only 3 per cent are homozygous.

**Lung cancer and cigarettes?** R. A. Fisher. Nature **182** (1958), pp. 108.

The author (*one of the world's leading biometricians*) criticizes the conclusion that since lung cancer can be shown to occur more frequently in cigarette smokers than non-smokers, then cigarette smoking is one of the causes of this disease. He proposes that both characteristics, i.e., cigarette smoking and lung cancer, may be influenced by a common cause; namely, the individual genotype.

To show that smoking preferences and habits may have a genetic component, he reported the results of a study carried out on 51 monozygotic and 31 dizygotic twins. The individuals were classified as to whether or not they smoked cigarettes, cigars, or pipes. Only 24 per cent of the monozygotic twin pairs were distinctly different in regard to smoking preference and habit as compared to 51 per cent for the dizygotic twin pairs. The author states that no matter how the data are arranged, the monozygotic twins show closer similiarity and fewer divergencies than the dizygotic twins. He concludes that the genotype can have a considerable influence on the particular habit of smoking adopted, and that the same genotype may predispose the individual to lung cancer. The high evidence of lung cancer among cigarette smokers could therefore be attributable to genotype and not smoking habit.

*Inherent in the above proposal is the assumption that lung cancer has a strong genetic component. Even though lung tumors in mice have been shown to be influenced by heredity, a similar relationship has not been demonstrated as yet in man. However, it should be added, that no critical study investigating the importance of genetics for this disease in man has been carried out.*

**Radiation and the sex ratio in man.** W. J. Schull and J. V. Neel. *Science* **128** (1958), pp. 343-348.

The two principal investigators of the genetic effects of the atomic bombings of Hiroshima and Nagasaki, have now concluded that the sex ratio among the children of the survivors of the bombings suggests the occurrence of induced sex-linked lethal mutations. Sex-ratio data reported previously concerning children born to unrelated parents were interpreted by these investigators as showing no conclusive genetic effect. Adding to these data the sex ratio in children born to related parents and analyzing the combined data by a different method gives results which convince the authors that they should reverse their previous conclusion.

Grouping the data according to different time periods—whether the parents were related or unrelated, fathers exposed but mothers not, mothers exposed but fathers not, both parents exposed, and then plotting within each group the frequency of male births on the estimated radiation dose received by the parent (s)—leads to 12 different regression coefficients. Only 1 of the 12 regression coefficients (mothers only exposed) is significantly different from zero at the 5 per cent level of significance. However, the authors point out that 11 of the 12 regression coefficients have the sign which is anticipated by genetic theory, i.e., genetic damage resulting from the bombings.

Omitting from the analysis the observations made on both parents unexposed, which corrects for the possible criticism that the regression coefficients are not independent, results in 10 of the 12 signs being compatible with the genetic theory. The significance of the signs in both analyses, rather than the individual regression coefficients, is suggestive of the induction of sex-linked lethal mutations by the atomic bombings.

**Hemagglutinins in uterine secretions.** H. Gershowitz *et al. Science* **128** (1958), pp. 719-720.

In an attempt to give another possible explanation for the slight decrease in frequency of children with blood group A among the offspring of O mothers and A fathers, the authors conducted a study to determine whether or not the secretions of the uterine cervix contains hemagglutinins which could set up a mechanism favoring fertilization by sperm cells with specific antigenic properties. Cervical secretions were obtained from 77 individuals. Hemagglutinins were detected in 17 cases; 15 of these were O individuals.

Assuming that an AO male can produce two antigenically different kinds of sperm cells, i.e., one with and one without antigen A, the authors propose that the hemagglutinins in O females could act to favor slightly fertilization by antigen-free sperm cells. The physiological mechanism is not known, but it could be due to impedance of motility or neutralization of the point of attachment of A types of sperm cells. Such a mechanism could even lead in some cases to infertility.

This demonstrates another way in which natural selection could act on the frequency of the ABO blood groups.

**Breast carcinoma and ABO blood groups.** I. S. Goldenberg and M. A. Hayes. *Cancer* **11** (1958), pp. 973-974.

Different investigators in Europe and the United States have presented data showing a striking correlation between carcinoma of the stomach and blood group A. This blood group occurs much more commonly among patients with this disease than in a suitable control group. The authors studied the blood group frequencies of 1,000 women with breast cancer who were admitted at the Yale-New Haven Medical Center, New Haven, Connecticut. These frequencies were then compared with a control group consisting of 75,904 blood donors. No significant difference existed between the two groups. The authors conclude that unlike stomach cancer, no correlation exists between breast cancer and the ABO blood groups.

**Familial trembling of the chin.** W. B. Wadlington. *Journal of Pediatrics* **53** (1958), pp. 316-321.

A family is described with eight individuals in three generations showing trembling of the chin. The distribution of affected individuals is compatible with the hypothesis that the condition is due to a sex-linked dominant gene. However, autosomal dominant inheritance, as reported in other families in the literature, cannot be ruled out.

The age of onset of these involuntary chin movements has been soon after birth in some of the family members. The trigger mechanism that may initiate the trembling

is some environmental stimulus such as anxiety, excitement, or depression. In some individuals, the precipitating cause can be a period of concentration, awakening abruptly, or strangely enough, playing a violin.

Electroencephalographic tests carried out on members of the family were not too informative. The effect of treatments with tranquilizers and anticonvulsants is still to be evaluated.

**Physiologic variation of renal function in twins:** Diuresis after water intake. B. M. Aschner and S. M. Gartler. *Acta Geneticae et Germellologiae* **7** (1958), pp. 19-24.

A study was carried out to investigate the role genetic factors play in normal regulation of water elimination through the kidneys. Six monozygotic and six dizygotic (same sex) twins were given 1000 cc. of water to drink within twelve to fifteen minutes after an overnight fast. The output of urine was then followed every half-hour for three hours.

The characteristics of diuretic response (total volume of urine excreted, time of onset of maximum urine flow, and the maximum rate of urine flow) were determined for each individual. Variations existed among the individuals in regard to all these characteristics, but the monozygotic twin pairs tended to be more similar for each characteristic than the dizygotic twin pairs. The characteristic exhibiting the greatest similarity for identical twins was maximum rate of urine flow. The mean intra-pair difference for the dizygotic twin pairs was three times as large as that for the monozygotic twin pairs. The differences were not statistically significant for the other two characters but were in the direction favoring a genetic hypothesis.

The authors conclude that their results indicate that genetic factors are operating in the elimination of ingested water by the normal kidney. They suggest that the genetic factors might possibly control distal tubular cell reabsorption activities.

**The significance of blood group conflicts and aberrant salivary secretions in spontaneous abortion.** C. McNeil *et al. American Journal of Clinical Pathology* **28** (1957), pp. 469-480.

*In a previous paper* (American Journal of Clinical Pathology, *28:145-151*), *the authors conclude that the simple theory of the secretion of ABH substances proposed by Schiff and Sasaki* (Ztschr. Immunitätsforsch., *77:129-139*) *should be reconsidered. The theory proposes that the ability to secrete aqueous soluble A and B and H substances in the saliva is inherited as a dominant trait. The authors have found exceptional individuals whom they describe as aberrant secretors. An example would be an AB person who secretes B and H but not A substances, or an A person who secretes H but not A substances.*

Data are presented suggesting that spontaneous abortion is correlated with the incompatibility of couples for the ABO blood groups and the aberrancy of one of the parents in regard to the salivary secretion of the ABH substances. Forty-seven couples were studied in which the woman had experienced 2 or more spontaneous abortions. For comparative purposes, 23 couples were selected in which the woman had not aborted and had given birth to 3 or more children. A highly significant number of the aborter group were incompatible for the ABO blood groups as compared with the non-aborter group. An example of an incompatible couple would be an O wife and an A husband. The mother could thus have an anti-body (anti-A) which could react with an antigen (antigen A) possessed by the fetus. Also, remarkably, in 20 of the 47 aborter couples, one of the parents was an aberrant secretor, while in the non-aborter group, not a single individual fell into this category. The authors conclude that in addition to incompatibility for the ABO blood groups, spontaneous abortion may also occur at a higher frequency if either parent is an aberrant secretor. A pos-

sible physiological mechanism responsible for this latter observation was not given.

*The authors present a theoretical genetic scheme to explain aberrancy of secretion which is not supported by the published data. They propose that the secretion of A, B, and H substances is controlled by three separate loci. At each locus there is an allele for secretion and non-secretion, with the heterozygote being a partial secretor. Their data suggests, rather, that if the amount of substance secreted, especially H, is influenced by genetic factors, then multiple genes are more likely involved.*

**Haemoglobin "Norfolk": A new haemoglobin found in an English family.** J. A. M. Ager *et al. British Medical Journal* No. 5095 (1958), pp. 539-541.

A new variant hemoglobin was discovered in a young Englishman during a survey of blood used for transfusion in Singapore. When the man's family was studied in England, it was shown that his father and younger brother also possess this new hemoglobin. None of these individuals showed any hematological or clinical abnormality. The electrophoretic mobility of the new type is faster than hemoglobin A and J, and considerably more slower than "Bart's" and N hemoglobin on paper at pH 8.6 (barbituate buffer).

The authors discuss the difficulties involved in naming new hemoglobins. In the past the procedure has been to use a letter designation. Since the pace of discovery of variant hemoglobins is likely to increase in the future, it is apparent that the letter designation is not satisfactory. The number of variant hemoglobins will likely far outnumber the letters of the alphabet. Furthermore, due to the time involved between discovery and publication and the lack of communication between all investigators, new hemoglobins discovered about the same time in different laboratories will likely be given the same letter designation. The authors suggest a scheme, as a basis of discussion only, which may alleviate the situation.

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## POPULATION

**Fertility and mental illness.** Aubrey Lewis. *Eugenics Review* **50**, 2 (July 1958), 91-106.

Past opinions and present evidence as to the possible role of fertility in determining the incidence of mental illness are reviewed in this article by a professor of psychiatry. Both the view of a century ago that natural selection tends to remove mental disorder from the population and the view of fifty years ago that the mentally ill threaten by high fertility to engulf society are rejected as too extreme. Such studies as have been made suggest that persons with schizophrenia tend to have fewer children than the general population, in considerable measure because of lower marriage rates. Those with manic-depressive psychosis exhibit approximately normal fertility. Thus far there has been no demonstration that the fertility of persons with neurotic disorders differs from the normal. Especially in the case of schizophrenia, the persistence of hereditary mental disease in the population apparently results to a significant degree from mutation.

An interesting feature of the relationship of the fertility of schizophrenics to that of the general population is that the difference between the two appears to vary with the level of the general fertility. This is among the considerations that lead the author to believe that social as well as biological and psychological factors that control the fertility of the mentally ill need further investigation.

Although the fear that the reproduction of the mentally ill constituted a threat to society has not been fulfilled in the last half-century, Aubrey Lewis is concerned about the possibility that changing social conditions, particularly the present laud-

able tendency to encourage a more "understanding" approach to persons with mental disorders, may have implications for the fertility of the group that would be serious. Hence an important reason for further research is to strengthen the basis on which advice about having children can be given to persons who may be predisposed to mental illness.

**Preferences in size of family and eventual fertility twenty years after.** Charles F. Westoff, Elliot G. Mishler, and E. Lowell Kelly. *American Journal of Sociology* **62**, 5 (March 1957), 491-497.

**Fertility through twenty years of marriage: a study in predictive possibilities.** Charles F. Westoff, Philip C. Sagi, and E. Lowell Kelly. *American Sociological Review* **23**, 5 (October 1958), 549-556.

A unique opportunity to study fertility behavior "longitudinally," that is, through the use of data collected from the same individuals at different times, is exploited in these two articles. During the 1930's information was collected from a group of 300 engaged couples for a study of marital adjustment. Twenty years later it proved possible to account for all 600 persons and to obtain data suitable for the analysis of fertility from 145 couples. The group is not representative of the general population, among other reasons because it contains too high a proportion of college-educated persons and too low a proportion of Roman Catholics. Although this limits the generality of any conclusions that can be drawn from the data, the reviewer agrees with the authors that the results are nonetheless of considerable interest.

The first of the two articles focuses on the family-size preferences originally stated by the engaged couples. Two chief findings are reported. First, family-size preference at the time of marriage was a poor predictor of actual family size observed twenty years later. Second, at the end of the twenty years recollection of the initial preference was often in error, tending to be closer than the actual initial preference to the family size that was achieved. A rough division of the sample into "planners" and "non-planners" of family size revealed that the correlations between initial preference and actual family size and between initial preference and recalled preference were higher for the planners than for the non-planners.

Having cast doubt upon the effectiveness of initial preference as a predictor of actual family size, the authors proceed in the second article to probe the data for other sociological and psychological variables that might be more accurate predictors. A correlation analysis of a number of family background and personal characteristics of the wives drew attention to five variables in particular: size of parental family, education of father, mental ability test score, a social adjustment scale, and age at marriage. Taken together, these variables exhibit a multiple correlation with total fertility of 0.49, a value considerably higher than the 0.27 correlation between initial preference and total fertility. This is taken by the authors to "confirm the hypothesis that certain sociological and psychological factors are better predictors of fertility than wife's own family-size preference expressed before marriage" (p. 556). The authors do not explicitly point out, however, that the greater success is achieved by the *group* of factors. Only one of the five, size of parental family, has by itself a higher correlation with total family size (0.29) than does initial preference.

To abstract from the effects on fertility of varying degrees of success in family planning, further analysis was carried out on data for the 68 couples who were classified as completely successful planners. For these persons the list of variables that correlate most highly with total family size is not identical with that for the total sample. In addition to initial family-size preference, size of parental family and age at marriage appear in both lists, but measures of socioeconomic status are notable for their absence in the case of the planners. A factor

analysis suggests that at least three factors must be taken into account in explaining the variance of fertility.

Pointing to the limited generality of their findings, the authors remark that their "analysis is intended only to confirm the possibilities of . . . prediction [of fertility] and to suggest avenues for more systematic investigation" (p. 556). Whether the former purpose has been achieved at this juncture seems to the reviewer open to question, but the latter is well served, as is demonstrated by the incorporation of leads furnished by this study into the formulation of further research now in progress.

**The control of human fertility.** Sir Solly Zuckerman. *Impact of Science on Society* **9,** 2 (1958), 61-78.

This general discussion presents, in lucid combination, historical, biological, sociological, and economic aspects of fertility control as a world problem. The essential points, as seen by the author, are quite unequivocally stated: the well-being of the world's people will depend upon widespread effective family limitation; all existing methods for controlling reproduction leave much to be desired; the prospects that a really satisfactory method will be developed are improving, but as yet there is no certainty of success in this endeavor, much less of success in the near future; even if an "ideal" contraceptive, perhaps an oral pill, were perfected, the difficulties of securing its world-wide adoption would be enormous.

The author is not without hope for the long run, however. "We need not doubt that reproductive rates will eventually fall as levels of economic activity rise. The urgent question is how long this process is going to take" (p. 78). Readers will note that this implies a more optimistic view than the fear sometimes expressed that high fertility may in some areas block any effective rise in economic output per person.

**Population pressure in under-developed countries and the need for population control.** S. M. Haider. *Pakistan Horizon* **10,** 3 (September 1957), 144-156.

Appearing as it does in a journal published by the Pakistan Institute of International Affairs, this article is of interest particularly as an indigenous view of the demographic problem of underdeveloped countries. The author believes that control of population growth will be essential to the improvement of the standard of living of many countries, including his own. To develop a foundation for this position, he brings together a substantial number of quotations from leading writers on demographic subjects of the last thirty years. The persistence of the population problem in recent decades despite human advances on many fronts is made more apparent by the major place Haider is able to give to ideas presented by E. A. Ross in 1927. Although readers who maintain a continuing interest in demography will not expect to find much that is new in a composite presentation of this sort, they may be struck by the assertion that "all population considerations in the under-developed countries should be fitted into the frame of reference known as optimum population" (p. 155). It would have been interesting for the author to develop this point more fully than he does.

GEORGE F. MAIR
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# NEWS NOTES

## Annual Meeting of the American Eugenics Society

The Annual Meeting of the American Eugenics Society was held on November 13, at 12:00 P.M. in Room 1815, 230 Park Avenue, New York, New York, the President, Harry L. Shapiro, presiding.

The Secretary and the Assistant Treasurer were appointed a committee to count the proxies for voting. One hundred ninety-seven proxies were counted.

The following directors for the term ending 1961 were elected by proxy vote:

| | |
|---|---|
| Dorothy Brush | Newton E. Morton |
| Watson Davis | Gardner Murphy |
| Lee R. Dice | J. P. Scott* |
| Dudley Kirk | P. K. Whelpton* |

*New Directors: J. P. Scott, Chairman, Division of Behavioral Studies, Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine; P. K. Whelpton, Director, Scripps Foundation for Research in Population Problems, Miami University, Oxford, Ohio.

The following amendments to the By-laws were adopted by proxy vote:

1. Amendment to Article I, Section 2. Members in the United States and Canada, dues $5.00; members outside the United States and Canada, dues $2.50. A subscription to Eugenics Quarterly is covered by $2.00 of the membership dues. (Note: At present the By-laws provide for membership with dues of $5.00.)

2. Amendment to Article IV, Section 1. A vacancy in any office may be filled for the remainder of the unexpired term by the Board of Directors. (Note: At present the By-laws provide for a vacancy in any office to be filled *until the next annual meeting* by the Board of Directors.)

3. Amendment to Article VI, Section 3. The Annual Meeting of the Society shall be held the second Thursday in November of each year. (Note: At present the By-laws provide for the Annual Meeting of the Society to be held at such date and at such place as shall be determined by the Board of Directors.)

Plans were discussed for future financing of the Society. The meeting was adjourned at 12:45 P.M.

## Tenth International Congress of Genetics

The Tenth International Congress of Genetics met from August 20-August 27 at Montreal, Canada. The American Eugenics Society acted as one of the sponsors of the Congress. A joint dinner with the American Society of Human Genetics was held at the Mount Royal Hotel in Montreal on August 23. Dr. William Boyd, President of the American Society of Human Genetics, and Dr. Harry L. Shapiro, President of the American Eugenics Society, delivered presidential addresses.

## International Symposium

A symposium on "Differentiation in Current Mating and Fertility Trends" will be held on Saturday, February 14, 1959, at the New York Academy of Medicine Building. The all-day conference, to be sponsored by the American Eugenics Society, will bring together a panel of European and American experts in the fields of clinical and population genetics, psychiatry, and demography.

The morning session will be under the chairmanship of Frederick Osborn, President of the Population Council, and will be concerned with general mating and fertility trends in modern populations. The afternoon program, chaired by Dr. Paul H. Hoch, New York State Commissioner of Mental Hygiene, will be devoted to a discussion of special reproductive patterns in the presence of psychiatric family problems.

Professional attendance is invited.

INTERNATIONAL SYMPOSIUM OF AMERICAN EUGENICS SOCIETY, NEW YORK CITY
February 14, 1959

*Differentiation in Current Mating and Fertility Trends*

Morning Session:

GENERAL MATING AND FERTILITY TRENDS

8:45—Registration and luncheon tickets.

9:00—General Genetic and Demographic Principles Basic to an Understanding of Variations in Reproduction. Introductory remarks by Chairman: Frederick Osborn.

9:10—Current Mating and Fertility Patterns and Their Demographic Significance. Speaker: Clyde V. Kiser, Ph.D., Milbank Memorial Fund; Discussant: Robert C. Cook, Population Reference Bureau.

9:45—Differentiating Effect of Intelligence and Social Status. Speaker: Anne Anastasi, Ph.D., Fordham University; Discussant, Joseph Zubin, Ph.D., Columbia University.

10:15—Biochemical Fertility Regulation. Speaker: Sheldon Segal, Ph.D., Population Council, Rockefeller Institute; Discussant, Alan F. Guttmacher, M.D., The Mount Sinai Hospital.

10:45—Intermission.

10:55—Consanguinity Effects. Speaker: William J. Schull, Ph.D., University of Michigan.

11:30—Problems of Selection. Speaker: James F. Crow, Ph.D.

12:00—Genetic Effects of Serological Incompatibility. Speaker: Howard Levene, Ph.D., Columbia University; Discussant: Richard E. Rosenfield, M. D., The Mount Sinai Hospital.

12:30—General discussion.

12:45—Luncheon.

Afternoon Session:

SPECIAL REPRODUCTIVE PATTERNS IN THE PRESENCE OF PSYCHIATRIC FAMILY PROBLEMS

2:00—Methods and Objectives of Modern Medical Genetics and Eugenics. Introductory remarks by Chairman: Paul H. Hoch, M.D., Commissioner of Mental Hygiene.

2:10—Disorders of Sexual Differentiation and Development. Speaker: Melvin M. Grumbach, M.D., Columbia University; Discussant: C. Nash Herndon, M.D., Bowman Gray School of Medicine.

2:40—Mating and Fertility Patterns in Special Population Groups:

a. Families with Mental Defect of Severe Neurological Conditions of Genetic Origin. Speaker: Jan A. Böök, University of Uppsala; Discussant: George A. Jervis, M.D., Letchworth Village.

b. Families with Early Total Deafness. Speaker: John D. Rainer, M.D., Columbia University; Discussant: W. Edwards Deming, Ph.D., New York University.

3:45—Intermission.

3:55—c. Families with Manic-Depressive Psychosis. Speaker: Aubrey Lewis, M.D., University of London; Discussant: Ørnuly Odegaard, M.D., Gaustad Mental Hospital.

4:35—d. Families with Schizophrenia. Speaker: Erik Essen-Möller, M.D.; Discussant: Erik Strömgren, M. D.

4:50—e. Potential Effects of Modern Treatment Methods. Speaker: Fritz A. Freyhan, M.D., Delaware State Hospital; Discussant: Erik Strömgren, M.D., University of Aarhus.

5:15—General discussion.

# BY-LAWS OF AMERICAN EUGENICS SOCIETY, INC.

*Historical Note*

The Constitution and By-Laws of American Eugenics Society, Inc., were adopted on January 30, 1926. The original Certificate of Incorporation was filed in the office of the Secretary of State at Albany, New York, on January 27, 1926. The incorporators were: Irving Fisher, Harry H. Laughlin, Henry Fairfield Osborn, Henry E. Crampton and Madison Grant.

Article I of the Constitution stated that the name shall be American Eugenics Society, Inc. Article II stated that the main objects of the Society shall be to promote the study and discovery of sound eugenics principles and of all matters in any way related thereto, and to make practical application of such principles to the improvement of the human race. Then followed a series of articles and by-laws all of which were later decided by legal advisers to be really by-laws. On September 23, 1937, Revised By-Laws were adopted as a substitute for the original Constitution and By-Laws and a certificate of amendment of the 1926 Certificate of Incorporation was filed in the office of the Secretary of State of New York at Albany.

The By-Laws have not been published by the Society since 1947. They are printed here with revisions since that date.

## ARTICLE I

*Members*

Section 1. The Society shall consist of members elected by the Board of Directors, or chosen in such manner as the Board of Directors shall from time to time provide. No person whose dues, as hereinafter prescribed, are in arrears more than one year shall continue to be a member of the Society.

Section 2. Members shall be divided into the several classes named below and shall pay annual dues in the respective amounts indicated:

Members in the United States and Canada, dues $5.00; members outside the United States and Canada, dues $2.50. A subscription to EUGENICS QUARTERLY is covered by $2.00 of the membership dues.

Honorary members. Any person entitled to special recognition because of research or the promotion of Eugenics may be elected to honorary membership upon a nomination signed by three members of the Society and approved unanimously by the Board of Directors. Honorary members shall be entitled to all the privileges of membership. No dues shall be required of honorary members.

Emeritus members. Any person who has been a member of the Society continuously for 25 years and has retired is eligible to request emeritus membership, which may then be granted at the discretion of the Board of Directors. Emeritus members shall pay no dues and shall have all the privileges of active membership.

Section 3. All members shall be entitled to receive the official journal, EUGENICS QUARTERLY, and such publications as may be issued through the Society except in cases where the Board of Directors decides that a certain publication requires a special charge.

## ARTICLE II

*Board of Directors*

Section 1. The Board of Directors shall consist of not less than fifteen (15) and not more than thirty (30) members and shall be divided into three classes equal numerically as far as possible. The term of the members of one class shall expire at each annual meeting of the Society upon the election and qualification of successors. At each annual meeting of the Society such successors to the class whose term then expires shall be chosen to serve for a term of three years, or until the election and qualifications of their successors. Vacancies in the Board of Directors, whether caused by death, resignation, or otherwise, may be filled by election at the next annual meeting of the Society or at any meeting of the Board of Directors, and persons so elected shall serve for the remainder of the unexpired term, or until the election and qualification of their successors. Any director may resign by a notice in writing to the President.

Section 2. The Board of Directors shall appoint each year a Nominating Committee consisting of three members of the Society whose duty it shall be to nomi-

nate to the Board of Directors members to succeed the class whose term expires at the next Annual Meeting. Written notice of the nominations approved by the Board of Directors shall be sent to members of the Society at least two weeks before the Annual Meeting at which the election is to take place. Additional nominations for such members of the Board of Directors may be made from the floor at the Annual Meeting, or in writing to the Secretary who shall present them at the Annual Meeting. Such nominations shall be added to the ballot if approval is voted by a majority of members present or represented by proxies. Only persons duly nominated as herein provided shall be eligible for election to the Board of Directors at any Annual Meeting.

Section 3. The Board of Directors shall be responsible for the custody and administration of the property and funds of the Society and shall have full management and control of its affairs.

## ARTICLE III

### *Advisory Council*

Section 1. The Board of Directors may appoint an Advisory Council.

## ARTICLE IV

### *Officers*

Section 1. The officers of the Society shall be a President, a Vice-President, a Treasurer and a Secretary. They shall be elected for terms of three years by the Board of Directors, the first term beginning as of January, 1947. The President and Vice-President shall not be eligible for election to more than two consecutive terms of three years each. The President may at any time appoint assistant officers and assistants for terms limited to the fiscal year. The same person may be elected as Secretary and Treasurer. All officers shall hold office at the pleasure of the Board of Directors or until the election and qualification of their respective successors. A vacancy in any office may be filled for the remainder of the unexpired term by the Board of Directors. No person who is not a member of the Board of Directors shall be eligible for election as President, Vice-President, Secretary, or Treasurer.

Section 2. The President shall be responsible for the administration of the affairs of the Society, subject to the Board of Directors. He shall preside at all meetings of the Society and of the Board of Directors at which he shall be present. Except as otherwise provided by resolution duly adopted at any meeting of the Board of Directors, the President shall sign for the Society all formal instruments and agreements and shall appoint all committees, the appointment of which is not otherwise expressly provided for. Unless the Board of Directors votes otherwise, he shall be Chairman of the Executive Committee, described below.

Section 3. In the absence or disability of the President, the Vice-President shall discharge his duties and exercise his powers.

Section 4. The Treasurer, subject to such regulations as may be prescribed by the Board of Directors, shall have the custody of the funds of the Society and shall have charge of the disbursement of its money. The Treasurer shall deposit the funds of the Society in such bank or trust company as may from time to time be designated by the Board of Directors. Such deposit shall be made subject to draft only on the signature of the Treasurer or the President or such other officer or officers, or member or members of the Society as may be designated by the Board of Directors for such purpose.

Section 5. At each Annual Meeting of the Society the Treasurer shall make a report of the accounts of the preceding fiscal year. He shall keep proper records of account and these shall be at all times open to the inspection of the members of the Board of Directors. At any meeting of the Society or of the Board of Directors the Treasurer shall, if called upon to do so, present an account showing in detail the financial status of the Society.

## ARTICLE V

*Committees*

Section 1. There shall be an Executive Committee of the Board of Directors consisting of seven (7) to nine (9) members, as the Board of Directors may decide. The Committee shall include the President, Vice-President, Secretary and Treasurer. The members of the Executive Committee other than said officers shall be elected by the Board of Directors at its first meeting after each Annual Meeting of the Society, to serve for one year, or until their successors shall have been elected and qualified. The Board of Directors may at any meeting fill vacancies in the Executive Committee. The Executive Committee shall exercise all of the functions of the Board of Directors between meetings of the Board.

Section 2. There shall be such other standing or temporary committees as the Board of Directors shall deem advisable. The membership of such committees shall ordinarily be drawn from members of the Society. The duties of the committees shall be those assigned to them by the Board of Directors.

## ARTICLE VI

*Meetings*

Section 1. Meetings of the Board of Directors shall be held at such times and places as the Executive Committee may from time to time decide. The President may call a meeting of the Board of Directors at any time upon not less than two days' notice in writing or by telegram. In the absence of specification, all meetings of the Board shall be held in the office of the Society in the City of New York. One-third of the members of the Board shall constitute a quorum.

Section 2. Meetings of the Executive Committee may be called by its Chairman, or by the President or Vice-President, and shall be called at the written request of any five members. Three members of the Committee shall constitute a quorum, provided notice of the meeting has been sent to all members by mail or by telegraph at least three days in advance of the meeting.

Section 3. The Annual Meeting of the Society shall be held on the second Thursday in November of each year, and notice of the meeting shall be sent by mail to members of the Society at least two weeks before the date is set.

Ten members shall constitute a quorum for the transaction of business. In the absence of a quorum a majority of those present at the time and place set for a meeting may take an adjournment from time to time until a quorum is obtained.

Section 4. A Special Meeting of the Society may be called at any time by order of the Board of Directors. At least five days' written notice of any such special meeting shall be mailed to each member of the Society. Ten members shall constitute a quorum for the transaction of business.

Section 5. In Annual or Special Meetings of the Society, as provided for in Section 3 and Section 4 above, any member of the Society may be represented by proxy.

## ARTICLE VII

*Fiscal Year*

The Fiscal Year of the Society shall be from January 1st to December 31st from and after January 1st, 1947.

## ARTICLE VIII

*Publications*

The Society may issue publications from time to time with the approval of the Board of Directors. The President shall each year appoint an Editorial Committee of three or more members, which shall edit the official journal, EUGENICS QUARTERLY, and any bulletins, pamphlets, leaflets or books to be printed for distribution by or for the Society.

### ARTICLE IX

*Amendments*

These By-Laws may be amended by a majority vote at any Annual or Special Meeting of members of the Society, provided that the proposed amendment is approved by the Board of Directors and copies mailed to members at least two weeks before the Annual or Special Meeting at which the amendment is to be considered.

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## *Multiple Birth Roster*

The New York City Department of Health has established a "Multiple Birth Roster." The Roster is intended to be a source of information for research workers in the fields of genetics, child development, etc. The Department will cooperate with researchers to supply them with some data which may be helpful to them to initiate genetic studies.

All multiple births involving at least two live infants are included in the Roster. All the identifying, demographic, and pregnancy information available on the birth certificate of each infant is punched on a tabulating card. A photostatic copy of the complete record of birth is also in the register, so that details not available on the punched card may be conveniently abstracted. The Roster will be kept up-to-date in three respects: adoption of a child, deaths during the first year of life, and data fed back to the Roster by the individual researcher. The Roster was initiated as of January 1, 1958 and will be continued indefinitely. At a later date an evaluation will be made to determine whether its usage by researchers warrants its continuation.

Researchers requesting information from the Roster will be expected to adhere to such requirements as the Department may deem necessary. All requests will be reviewed as to the qualifications of the investigator and the value of the proposed study. Investigators may be asked to allocate clerical staff to assist in selecting the data requested. Facts elicited by home interviews and/or abstract of records are to be made available by the researcher to other researchers to avoid duplications of efforts.

Formal requests should be submitted to Dr. Harold Jacobziner, Assistant Commissioner for Maternal and Child Health Services, New York City Department of Health, 125 Worth Street, New York 13, New York.

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